

INDIVIDUAL DIFFERENCES IN
THE READING ABILITY OF
COLLEGE STUDENTS

by

ERNEST MITCHELL ANDERSON, B.S., M.A.

*The Abstract of a Thesis Submitted in Partial Fulfilment
of the Requirements for the Degree of
Doctor of Philosophy*

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CHAPTER I

INTRODUCTION

Origin of the Problem

Higher education is today confronted with the problem of meeting new and rapidly changing conditions and in so adjusting itself to these conditions that it will maintain and increase its usefulness.

A real interest is being manifested by educational leaders in the solution of college problems through the use of scientific investigation and the application of the results so obtained. This interest is shown by the numerous recent publications on the subject.¹

Foremost among problems demanding attention is that of the improvement of college instruction. Instruction in the elementary and secondary schools has been greatly improved by individualization. It is conceivable that the same method of attack may offer possibilities for the improvement of college teaching.

Before individualization of instruction is attempted in college, it is necessary to discover to what extent, if any, college students differ in relation to the various elements of instruction. If investigation shows a wide range of variability, then it would seem that there is a place for individualization in college instruction as well as in that of the elementary and secondary schools.

Individualization of instruction can be obtained only through the individualization of the different elements of instruction. Of these elements, reading is and will continue to be one of the most important. Comparatively little, however, has been done in the investigation of the individual differences in the reading ability of college students. We have apparently taken it for granted that all college students can read sufficiently well any assignment given to them and that one student can read as well as another.

This investigation is made on the assumption that the same wide range of reading ability that has been found in elementary and secondary pupils is also present in college and university students, and that the implications are just as significant.

In order to individualize reading, it is necessary to know, first, the reading ability of the different students; second, the reading demands made of students in specific courses; and third, the extent to which individuals are able to meet these demands.

Statement of the Problem

The object of this investigation is, therefore, to discover and study, first, some of the individual differences in the reading ability of college students, and second the actual performance of these students in the type of reading material that they are required to read in one specific course, educational psychology, with a view of making some contribution to the improvement of college instruction.

Reading Defined

Reading is a complex procedure which varies in complexity with the type of material and the purpose of the reader. It may involve any one or all of the following: mere word recognition and comprehension, comprehension of sentences, comprehension of paragraphs, comprehension of whole chapters, and the comprehension of long articles or of whole books. It may involve the mere getting of facts from the

¹Haggerty, M. E., *The Improvement of College Instruction*, School and Society, Volume XXVII, January 14, 1928, pp. 25-37.

Pressey, S. L. and others, *Research Adventures in University Teaching*, Eighteen Investigations of College and University Problems, 1927.

printed page, or it may involve using these facts in the solution of highly complex real or verbal problems. In the latter case, reading becomes largely a matter of reasoning.

According to Thorndike, "Understanding a paragraph is like solving a problem in mathematics. It consists in the selection of the right elements of the situation and putting them together in the right relations, and also with the right weight or influence or force for each. The mind is assailed as it were with every word in the paragraph. It must select, repress, soften, emphasize, correlate and organize, all under the right mental set or purpose or demand."²

For the purposes of this study, reading ability is thought of as the ability to do this more complex type of reading. It is this type of reading, closely akin to reasoning, that the college student is required to do. He must get facts from the printed page; he must use these facts in the solution of real or verbal problems; he must be able to read critically and to make fine discriminations.

Work Done in Related Fields

Examination of the literature in the field of reading shows that there has been an immense number of investigations of the reading ability of elementary school pupils. Considerable study has been made of the reading ability of high school pupils. More recently, some little investigation has been made of the field of college reading. These studies, however, have been confined primarily to the study of central tendencies rather than to the study of individual differences.

As early as 1897, individual differences in the reading ability of university students were mentioned by J. O. Quantz,³ working under Professor Jastrow of the University of Wisconsin. He reports that the "motor-minded" type of individual reads more slowly than either the "auditory-minded" or "visual-minded" type. He also finds that the rapid reader not only does the work in less time but does superior work and retains better. He found lip movement to be a serious hindrance to the speed of reading. He observed also that a close relationship existed between mental alertness and the speed of reading. This investigation was based on the laboratory-experimental method, and the information was derived chiefly through a study of visual perception as measured by the Hipp chronoscope.

Investigations by Gray⁴ and by Judd and Buswell⁵ show that the eye movements of university students and the period of fixation vary with the individual, with the purpose and with the type of material read.

Whipple and Curtis,⁶ who conducted some laboratory experiments with six university students and instructors, found rather decided differences in the ability to skim reading materials. While the numbers here are too small to be conclusive,

²Thorndike, Edward L., *Reading as Reasoning: A Study of Mistakes in Paragraph Reading*, Journal of Educational Psychology, June 1917, Volume VIII, Number 6, p. 326.

³Quantz, J. O., *Psychology of Reading*, Psychological Review, Series of Monograph Supplements, Volume II, Number I, (Whole Number 5), December, 1897.

⁴Gray, Clarence T., *Types of Reading as Exhibited Through Tests and Laboratory Experiments*, Supplementary Educational Monographs, Volume I, Number 5, University of Chicago, 1917.

⁵Buswell, Guy T., *Fundamental Reading Habits, A Study of Their Development*, Supplementary Educational Monographs, Number 21, University of Chicago, 1922.

⁶Judd, Charles H. and Buswell, Guy T., *Silent Reading, A Study of the Various Types*, Supplementary Educational Monographs, Number 23, University of Chicago, 1922.

⁶Whipple, G. M., and Curtis, Josephine N., *Preliminary Investigation of Skimming in Reading*, Journal of Educational Psychology, Volume VIII, 1917, pp. 333-349.

they are large enough to be indicative of what would probably be found if greater numbers were used.

L. W. Webb,⁷ who studied the relation between the reading ability of college students and performance on mental tests, concludes that rapidity of comprehension in reading is one of the large factors in determining the score a student makes on an intelligence test. He found a positive correlation of .49 between Army Alpha and rate of reading; .68 between Army Alpha and reading comprehension; .64 between Thurstone A and B and rate of reading; and .58 between Thurstone A and B and reading comprehension. In these correlations, rate and comprehension of reading were each determined from Monroe's Standard Silent Reading Tests.

D. A. Worcester,⁸ who studied the ability of 200 college freshmen to follow directions presented orally and in writing, found that reading difficulties influenced the scores made on mental tests as measured by Army Alpha, Test 1, Form 5.

Carter V. Good,⁹ who studied the relative merits of extensive and intensive reading in the social sciences in college, found that extensive reading is superior to intensive reading in range and accuracy of information, ability in problem solving, and in ability to see relationships or to outline, while intensive reading of a small amount of material enables the student to reproduce practically as much as he is able to reproduce after a superficial reading of a larger amount. He suggests that the lowest fourth in intelligence be given a minimum reading assignment based on fundamentals in the course. He found that the lowest fourth of the class get facts fairly well but fail where judgment is required.

In some researches carried out in Indiana University under the supervision of William F. Book,¹⁰ it was found that unsuccessful students in orientation courses were poor in reading. He reports marked differences in the range of reading ability as measured by the Whipple reading tests. The poorest student makes a score of one while the best student scores nineteen out of a possible twenty points. The women score slightly higher than the men. He finds a high relationship between reading ability and academic success, but mentions no correlations. Freshmen, who were assigned material to be read on one day and tested on what they retained the next day, gave the following results: the men retained 34% and the women 43% of the total possible number of facts; and the range for the men was from 3% to 85%, while that for the women was from 3% to 94% of the total possible number of facts involved. He also found that students under instruction on how to study improved their average "efficiency" 102%, while some students improved as much as 250%. Ability to master an assignment increased from 60% to 97.3%. The time element used in estimating efficiency seems to have been based on student reports.

Bess L. Crofoot,¹¹ who conducted a study at Hampton Institute, reports that adult students 21 to 43 years of age with an average age of 31 made remarkable improvement in reading ability when given instruction on how to read more efficiently.

⁷Webb, L. W., *Ability in Mental Tests in Relation to Reading Ability, School and Society*, Volume XI, May 8, 1920, pp. 567-570.

⁸Worcester, D. A., *The Ability to Follow Oral and Written Directions*, Educational Research Bulletin (Ohio State University), Volume IV, September 9, 1925, pp. 250-251.

⁹Good, Carter V., *An Experimental Study of the Merits of Extensive and Intensive Reading in the Social Sciences*, School Review, Volume XXXIII, December, 1925, pp. 755-770.

¹⁰Book, William F., *How Well College Students Read*, School and Society, Volume XXVI, August 20, 1927, pp. 242-ff.

¹¹Crofoot, Bess L., *Remedial Reading*, School and Society, Volume XXV, February 12, 1927.

Henryetta D. Sperle,¹² in an investigation carried on at the New Jersey State Teachers College and State Normal School, Montclair, N. J., reports that scores made by college freshmen on the Whipple reading test ranged from 3 to 17 out of a possible score of 20.

Howard McClusky¹³ has investigated some phases of college reading ability but at this time his findings have not been published. Dr. McClusky has been kind enough to write personally concerning the results of his investigation as related to this study, and acknowledgments will be made when such results are mentioned.

Theo. W. H. Irion¹⁴ has made careful investigations in which he found wide variations in the ability of ninth grade students to comprehend English literature. While this study was confined to ninth grade students, it throws considerable light on the general subject of individual differences in reading comprehension.

While the studies mentioned above have some bearing on the general problem of individual differences in the reading ability of college students, the specific problem as defined in this study is uninvestigated.

¹²Sperle, Henryetta D., *Some Difficulties Experienced by First-Year Students in Teacher Training Institutions*, Teachers College Record, Volume XXIX, April, 1928, p. 625.

¹³McClusky, Howard, *Unpublished Doctor's Dissertation*, University of Chicago.

¹⁴Irion, Theo. W. H., *Comprehension Difficulties in the Study of Literature*, Teachers College, Columbia University Contributions to Education, Number 189, 1925.

CHAPTER II RESEARCH INSTRUMENTS USED

General Statement

The type of research instruments used in any investigation is determined by the nature of the problem. In this particular study, the object was to discover and study the individual differences in reading ability of college students with particular attention given to reading in the field of educational psychology.

The nature of the problem made it necessary to analyze and measure the different elements involved in reading ability under varying conditions. The instruments used, therefore, are largely test devices.

In order to obtain certain personal information not procurable from other sources, a questionnaire was also used. During the year opportunity was offered for conferences with individual students in which information was obtained that proved of value in the attack on the problem.

Tests Used

Since testing was used so extensively, it is necessary to discuss at some length the tests used. Three general types of tests were employed: first, well-known standardized mental tests, reading tests, and vocabulary tests; second, specially constructed reading tests based on reading material adapted from textbooks in educational psychology; and third, the regular tests and examinations constructed by the instructor for the purpose of assigning credit in the course. The following are the tests used:

A. Standardized tests

I. Mental tests

Otis Self-Administering Tests of Mental Ability, Higher Examination, Form A
Otis Self-Administering Tests of Mental Ability, Higher Examination, Form B

II. Reading tests

Whipple's High-School and College Reading Test, Form A
Whipple's High-School and College Reading Test, Form B
Van Wagenen Reading Scales, General Science, Scale A
Van Wagenen Reading Scales, English Literature, Scale B

III. Vocabulary test

Holley, Sentence Vocabulary Scale, Series 3 B

B. Special reading tests constructed for this study

Test I, Suggestions for Effective Learning

Test II, Individual Differences

Test III, Efficiency as Influenced by External and Internal Conditions

Test IV, Transference of Training

C. Regular tests and examinations given by the instructor

Standardized Tests

The standardized tests were carefully selected, each for a specific purpose. They are well known and require no special comment. The Otis Self-Administering Tests of Mental Ability were used to determine whether the subjects were normal college students with reference to intelligence. It was desired also to get a measure of mental ability for purposes of comparison and correlation with other measurements. Both forms of the Otis tests were given to each student and the average of the two intelligence quotients obtained was used in all computations involving the factor of intelligence.

Whipple's High-School and College Reading Test was given in order to get a general survey of the reading ability of each student, and to determine whether the groups tested were normal college groups with reference to reading ability. Both forms were given and the average of the two scores used in all computations involving the Whipple test.

The Van Wagenen Reading Scales, General Science Scale A and English Literature Scale B, were given in order to find the relationship between a student's abilities to read different types of material. It was planned to correlate these tests with each other, with the Whipple test, and with the Special Tests based on material from textbooks in educational psychology. The Van Wagenen Reading Scales were standardized primarily for use in high school, but seem to be sufficiently difficult for college students with the exception of a few students who went above the upper range as standardized. In these few cases a proportional increase in the final score was allowed.

It was desired to get some measure of the vocabulary of each student inasmuch as word knowledge seems to be closely related not only to reading ability but to intelligence as well. Holley's Sentence Vocabulary Scale was selected for this purpose.

Special Reading Tests

Purpose

One of the objects of this investigation was, as previously stated, to discover and study the actual reading performance of college students on the type of material assigned to them in courses in educational psychology. It was desired to give particular attention to the individual differences of students in reading this type of material. Since no tests had been constructed for this particular purpose, it was necessary to build up a number of tests adapted to our needs.

It is realized that test construction is a rather difficult and technical procedure, requiring more than a superficial knowledge of test building. The writer felt justified, however, in attempting the task by reason of knowledge gained in special courses in test building, practice in the construction of tests under expert guidance, constant reference to leading authorities¹ in the field, and five years' actual experience in the construction and administering of objective examinations with college and university students.

In order that the tests might be more valid, it was decided first just what factors should be tested and then tests were constructed for the specific purpose of determining the performance on each of these factors.

The Special Tests were designed to show, first, the ability of each student to comprehend facts in the reading material found in textbooks used in courses in educational psychology, and second, the ability to apply these facts to verbal problems representative of the real problems met in educational practice. These are the two chief reading demands made of college students in courses in educational psychology.

Since the subject-matter in educational psychology varies within itself, the four Special Tests were each based on a different type of material. This was done in order to discover if the student's performance is constant for different types of material in the same subject. The material and construction of each of the four Special Tests will be discussed more fully later in this chapter.

More specifically, it was planned that the Special Tests would furnish data on the following questions:

¹Thorndike, E. L., *Mental and Social Measurements*, 1913. Mc Call, William A., *How to Measure in Education*, 1922. Wood, Ben D., *Measurement in Higher Education*, 1923.

1. What are the individual differences in the ability of students to get facts from the material found in textbooks in educational psychology?
2. What are the individual differences in the ability of students to apply these facts in the solution of verbal problems?
3. What is the relation between getting facts and applying facts? In other words, is the person who is good in getting facts also good in applying them?
4. How do individuals differ in the ability to read different types of subject matter as found in text-books in educational psychology.
5. What is the correlation between the abilities to read different types of material as found in educational psychology?
6. How do students differ in the number of facts comprehended in a given selection?
7. What is the relationship between the ability to read material in educational psychology and scholarship in the subject?
8. Is the lack of reading ability a serious limiting factor in getting a course in educational psychology?
9. How does the ability to read material in educational psychology compare with the ability to read English literature, general science, and material as found in the Whipple reading tests?
10. How does the ability to read material in educational psychology compare with the ability in general word knowledge as shown by the Holley Vocabulary Scale?
11. What is the correlation between the ability to read material in educational psychology and intelligence as shown by the Otis Self-Administering Tests of Mental Ability?

Form of Special Tests

The four Special Reading Tests were all constructed on the same general plan, differing only in content and the length of the selection to be read. Each test consisted of the following elements:

1. Brief directions as to what was to be done
2. Material to be read
3. Ten multiple-choice questions, of five statements each, exhausting or giving a reliable sampling of the facts contained in the selection to be read
4. Sixteen educational problems or practices related to the facts contained in the reading material. The student was asked to mark each of these problems true or false, also to write in parentheses just before each problem a number corresponding to the number of the principle in the reading material with which it agreed or disagreed. This was done to cause the student to base his answer on the material read rather than on guess or general information. The scores based on the ability to locate the principle were treated separately in part of the computations since it was found that there were certain rather striking relationships between the ability to locate the principle and other factors.

Sources of Material of Special Tests

Representative reading material from four important topics in educational psychology was carefully selected and adapted from the following widely-used books:

Gates, *Psychology for Students of Education*

Gates, *Elementary Psychology*

Judd, *Psychology of High-School Subjects*

Perrin and Klein, *Psychology*

Skinner, Gast, and Skinner, *Readings in Educational Psychology*

Starch, *Educational Psychology*

Problems representative of those exercises given students of education were deliberately constructed to fit the principles contained in the reading selections. While it was necessary for the form of the problems to be largely original with the writer, the content was based on exercises and discussions found in the following books

Averill, *Elements of Educational Psychology*

Bagley and Keith, *An Introduction to Teaching*

Colvin, *The Learning Process*

Davis and Lewis, *Problems of the Junior High School*

Gates, *Psychology for Students of Education*

Knight and Ruch, *Syllabus for a First Course in Educational Psychology*

Lull and Wilson, *The Redirection of High School Instruction*

Mead, *Learning and Teaching*

Waples, *Procedures in High School Teaching*

Whipple, *Problems in Educational Psychology*

Woody, *Problems in Elementary School Instruction*.

Material and Purpose of Each of the Four Special Tests

The material of the four Special Tests was deliberately varied in order to test the student's ability to read different types of material in educational psychology.

Test I, *Suggestions for Effective Learning*, was designed to measure the student's ability to read rather abstract condensed material typical of summaries found in textbooks in educational psychology.

Test II, *Individual Differences*, consisted of new material of the ordinary expository type that predominates in textbooks in educational psychology. This material was not particularly difficult, being a rather straightforward and clear discussion of individual differences.

Test III, *Efficiency as Influenced by External and Internal Conditions*, was designed to measure the student's ability to comprehend and apply facts somewhat contrary to popular opinion, since the student must frequently read such material in psychology, physiology, and biology.

Test IV, *Transference of Training*, consisted of psychological material of a more complex and technical nature, involving two or more conflicting ideas, one of which was implied as correct. The ability to comprehend and apply facts involved, in this case, a careful weighing of the evidence on each side, and brought in the use of judgment and discrimination between rather fine points. The material was difficult but yet of the type demanded in practically all courses in educational psychology.

Test Criteria

Students of test construction such as Thorndike, McCall, and Wood agree that a good test must meet the standards of objectivity, validity, and reliability. The four Special Reading Tests were constructed to satisfy these standards.

Objectivity of Special Tests

The Special Reading Tests have a high degree of objectivity. The directions were printed, brief, concise, and clear. The scoring was done by means of keys carefully constructed as the tests were built up. Each answer was right or wrong, no partial credit being given. The objectivity of the treatment of the results was insured by the use of statistical procedure.

Validity of Special Tests

The Special Tests must necessarily meet two requirements from the standpoint of validity. First, they must be valid in that they test reading ability; and second,

they must be valid in that they are based on the type of reading material found in textbooks and references used in courses in educational psychology.

The first requirement is met in the most direct way possible, by measuring the response made by the student to an actual reading situation in which he shows his ability to get and apply facts.

The second requirement is met by carefully selecting and adapting reading material and problems from textbooks and manuals actually being used in courses in educational psychology by representative colleges and universities.

Reliability of Special Tests

The reliability of the Special Tests was determined by finding the correlation between the odd items and the even items of each test by means of the Pearson formula adapted for use with the assumed mean.² From this correlation of half test against half test was calculated the correlation of whole test against whole test by means of the Spearman-Brown formula.³ The probable errors of the coefficients of correlation were found by reference to "A Serviceable P. E. r Table" by Herbert A. Toops and Zaida F. Miner.

Self-correlations were found for each of the four separate tests and for the four tests combined. They were based on the results from 237 cases. The self-correlations of whole test against whole test and their probable errors are found in Table I.

TABLE I
Self-correlations obtained by correlating whole test against whole test

	Test I	Test II	Test III	Test IV	All 4 Tests
Self-r	.76	.81	.76	.92	.93
P. E. r	.02	.01	.02	.01	.01

Inspection of the self-correlations found in Table I shows that each of the four Special Tests and the four tests combined have a high self-correlation. All the self-correlations are high enough to give sufficient reliability for experimental purposes and at least two of them, those of Test IV and for all four tests combined, compare very favorably with good standardized tests in general use. The P. E. r's are small, indicating a high degree of reliability.

The indices of reliability⁴ for the Special Tests are as follows: Test I, .87; Test II, .90; Test III, .87; Test IV, .96; four tests combined, .96. These figures compare very favorably with those of standardized tests. Test IV and the four tests combined show an especially high index of reliability.

Reliability of Separate Elements of Special Tests

Since in part of this investigation we desired to treat comprehension of facts and application of facts as two separate elements in reading ability, it was necessary to determine the reliability of these separate elements. The scores on comprehension of facts in all four tests were combined into one group; the scores on application of facts were combined into a second group. The reliability of each group was determined by the same methods used in determining the reliability of the four separate tests. The self-correlation of whole test against whole test was .78 for Fact Comprehension and .92 for Application of Facts, with corresponding probable errors of .02 and .01. The indices of reliability were .88 and .96 respectively.

²McCall, *How to Experiment in Education*, p. 229

³McCall, *How to Experiment in Education*, p. 111.

⁴Kelly, *Statistical Method*, p. 206

From the evidence presented in this chapter, we may safely conclude that the Special Reading Tests meet the requirements of objectivity, of validity, and of reliability and that any data derived through their use may be used with assurance.

Regular Tests and Examinations Given by the Instructor

We desired to make certain comparisons between scholarship in the course in educational psychology and the performance on each of the reading tests. It is, therefore, necessary to discuss briefly the tests and examinations on which scholarship in the course was based.

The tests and examinations were all carefully made by the regular instructor in the course. They were objective in nature and chiefly of the true-false and multiple-choice type. All scoring was done by means of keys.

Questionnaire

In order to obtain certain personal information not procurable from other sources a short questionnaire was used. While realizing the defects of the questionnaire as a research instrument, we believe that the information obtained through this questionnaire was far more reliable than that usually obtained in this manner.

The questionnaire used in this study was carefully constructed with a definite purpose in mind. It was administered under supervision during the regular classroom period. It was filled out by the students in a thoughtful and careful manner as was indicated by the questions asked by the different students and by the care and fullness of the answers to a question asking for volunteer personal information as to factors that may have influenced the student's reading ability favorably or unfavorably. Only a small part of the information derived from the questionnaire is treated in this study.

CHAPTER III DESCRIPTION OF SUBJECTS TESTED

General Description

In order that our investigation be valid, it was necessary that the subjects be unselected and fairly representative of college students. To determine if our subjects met these requirements and also to furnish information for certain comparisons to be made later as to how college reading ability is influenced by sex, age, social status, and other factors, we made a detailed investigation of the individuals in the groups. A brief summary follows.

The subjects tested were 237 University of Missouri students enrolled in Educational Psychology, Course A102, during the fall and the winter semesters of 1927-1928. The classes were taught by Professor Theo. W. H. Irion, whose interest and cooperation made this study possible. There were 145 people in the fall semester group divided into two sections of 78 and 67 each. In the winter semester group there was one section of 92 people.

Sex of Subjects

The distribution of the 237 subjects according to sex was as follows: fall semester 40 men and 105 women; winter semester 26 men and 66 women; for the two semesters combined 66 men and 171 women. The women are considerably in the majority; however, the 66 men furnish enough cases to be fairly significant in our computations.

Age of Subjects

The range of ages, based on nearest birthday, was from 17 to 46, which is about as wide as would be found in any group of college students. Eighty-six per cent of the subjects were between the ages of 19 to 23 inclusive, the mean age being 21.68, which is about normal for a group of this kind. Our subjects were, therefore, a group of typical, unselected college students from the standpoint of age.

Nationality of Subjects

The subjects were all American-born except one, who was born in Scotland. They represented the older American stock, being chiefly of English, German, Scotch, and Irish ancestry. They are typical of the stock to be found in the Middle Western states.

Social Status of Subjects

The social status of the subjects, as indicated by the occupation of their fathers was as follows: business 75, farmer 73, professional 44, miscellaneous 32, and undetermined 13. The miscellaneous group was composed of skilled laborers, salesmen, clerical workers, railway employees, and state officials. In the undetermined group the fathers were listed as dead or retired. The different occupational groups are well represented, indicating a fair sampling of unselected subjects.

Classification as to Year in College

The 237 subjects were distributed according to year in college as follows: Sophomores 40, Juniors 151, and Seniors 46. The relatively large number of Juniors is due to the fact that Educational Psychology is primarily a Junior subject; however, the numbers of Sophomores and Seniors are sufficiently large to show any significant differences in reading ability, should any exist.

School or College of Enrollment

The distribution of the 237 subjects according to school or college of enrollment was as follows: Education 100, Arts and Science 83, Agriculture 22, Business and Public Administration 12, Fine Arts 9, Journalism 7, Engineering 3, and Law 1.

It will be seen that eight different schools and colleges of the University are represented. There are 100 students from the School of Education, 83 from the College of Arts and Science, and 54 from six other divisions combined. The School of Education and the College of Arts and Science are well represented and, by combining the students from the other six divisions, we have three rather well represented groups of sufficient numbers to show any outstanding differences, should any exist, in the reading ability of college students as influenced by school or college of enrollment.

Geographical Distribution of Subjects

The 237 subjects represented 17 states, there being 198 from Missouri and 39 from 16 other states. The 198 subjects from Missouri represented 65 different counties well distributed over the whole state. Taken as a whole, the group is unselected and not influenced to any great extent by the conditions of any particular locality.

Intelligence of Subjects

The distribution according to intelligence, as indicated by the average of the two intelligence quotients from Forms A and B of the Otis tests of Mental Ability, is fairly symmetrical but somewhat skewed to the left. The range for the fall semester group was from 130.5 to 88 or 52.5, with a mean of 115.8, a standard deviation of 9.3, and a coefficient of variability of 8.03. The range for the winter semester group was from 129 to 91.5 or 37.5, with a mean of 112.23, a standard deviation of 8.35, and a coefficient of variability of 7.46. The mean for the winter semester group is 3.5 points lower than that for the fall semester group. The winter semester group is also a little less variable than the fall semester group. In general, the distributions of the two groups are very similar.

It is believed that, from the standpoint of intelligence, these two groups approximate normal groups closely enough to be satisfactory for the purposes of this investigation.

Conclusions as to the Nature of the Subjects

We have investigated the nature of the subjects with respect to sex, age, nationality, social status, class in college, school or college of enrollment, geographical distribution and intelligence. In each case, we have found them to be a representative group of normal, college students. We believe, therefore, that the subjects are satisfactory for the purposes of this study.

CHAPTER IV TECHNICAL RESEARCH PROCEDURES EMPLOYED

Two Separate Studies Made

We had during each of the two semesters a group of students in educational psychology available for the purposes of this investigation. We had the choice of combining the data from the two groups or of treating the data from each group separately, making two independent studies. We chose the latter method because of the following advantages:

1. Two studies giving similar results are more convincing than a single study.
2. Two studies offer an opportunity to discover if the performance is similar for the two groups; if the performance is not similar, there is a better chance to discover the causes of any variations.
3. Two separate studies offer a chance to vary certain factors if desired.
4. Keeping the groups separate prevents the possible combining of two groups that might be radically different in some particular factor.
5. The separate treatment does not prevent the combining of the data from the two separate studies if desired for any particular purpose.

Test and Measurement Technique

The technique employed in any study is determined by the nature of the problem. Since our problem was largely exploratory in nature, merely discovering reading proficiency as it exists, the test and measurement technique was the chief one used.

Administering the Tests

Since the validity of the test and measurement technique depends to such a great extent on the care and accuracy with which it is used, the greatest care was taken to see that all the tests were properly administered. They were given as a part of the regular classroom procedure, under normal classroom conditions, and were looked upon by the students as an integral part of the course. The attitude of the subjects towards the testing program was favorable.

Special effort was made to see that the students worked well up to the maximum on all tests since genuine individual differences do not appear unless students are working near the maximum. The students were asked to do their best on each test. On the standardized tests, there was a certain amount of competition, as each individual was given his score and relative rank in the group. In the Special Tests, the students were given credit toward semester grades for the scores made.

In the administering of all the standardized tests, the directions given by the author of each test were followed carefully. The time, on all tests requiring an exact amount of time, was checked by two watches, one of which was a stop watch. On the other tests, just barely enough time was given for the slower people to finish. It might be noted here that the Whipple reading tests are speed tests as well as comprehension tests. All the other reading tests are power tests in which the individual has a reasonable amount of time to finish.

The Special Tests were administered in the same general manner as the standardized tests. No oral directions were given except that the students were told to follow carefully all directions given in the tests. Since these tests were designed to measure reading ability as a form of reasoning used in study, the students were given sufficient time to finish.

As previously stated, all tests were given during the regular class period. During the fall semester, one section met at 9:00 o'clock and the other section at 10:00 o'clock. During the winter semester, the class met at 9:00 o'clock.

The testing was distributed over the major part of each semester with the tests given in the following order:

- Otis Self-Administering Test Form A
- Whipple's High-School and College Reading Test Form A
- Otis Self-Administering Test Form B
- Whipple's High-School and College Reading Test Form B
- Test I (Special) Economical Learning
- Holley, Sentence Vocabulary Scale
- Van Wagenen Reading Scales, General Science, Scale A
- Test II (Special) Individual Differences
- Van Wagenen Reading Scales, English Literature, Scale B
- Test III (Special) Efficiency as Influenced by External and Internal Conditions
- Test IV (Special) Transference of Training

The tests during the winter semester were given at approximately the same relative time as those of the fall semester with reference to each other and with reference to the development of the course, with the exception of Special Test IV, which was given to the winter group before the general subject covered by the test had been discussed in class. Reference will be made to this exception in the discussion of results in Chapter V.

Questionnaire

A short questionnaire was used in order to obtain certain personal information about the subjects not available from other sources. The questionnaire was administered under supervision, being carefully filled out by the students during a regular class period. The information used from the questionnaire was of the type that lent itself to objective, statistical treatment.

Statistical Procedure

The test and measurement technique of necessity requires certain statistical procedures in the treatment and interpretation of the data. The statistical formulae employed in this study are those in general use and may be found in any of the leading texts on statistics or measurement.

All calculations were made with the utmost care and, in addition were carefully checked. Any unusual differences between the results from the fall and the winter groups were checked with special care in order to see that the differences were not due to errors in calculations.

CHAPTER V RESULTS OBTAINED

Introduction

In the four preceding chapters, we have discussed at length the purpose of this investigation, the research instruments used, the nature of the subjects tested, and the technical procedures employed. It is now necessary for us to give in detail the results obtained. These results will be discussed under three main divisions:

- A. INDIVIDUAL DIFFERENCES IN READING ABILITY AS SHOWN BY CENTRAL TENDENCIES AND DISPERSIONS.
- B. THE NATURE OF INDIVIDUAL DIFFERENCES IN READING ABILITY AS SHOWN BY CORRELATIONS.
- C. INDIVIDUAL DIFFERENCES IN READING ABILITY AS INFLUENCED BY SEX, AGE, SOCIAL STATUS, YEAR IN COLLEGE, SCHOOL OR COLLEGE OF ENROLLMENT, WHERE STUDENT FIRST LEARNED TO READ, EARLY INSTRUCTION IN SILENT READING, AND MANNER OF SPENDING LEISURE TIME WHEN A CHILD.

Some interpretation will be given in this chapter in connection with the presentation of the results; however, a more comprehensive statement will be made in Chapter VI concerning the interpretation of our findings.

- A. INDIVIDUAL DIFFERENCES IN READING ABILITY AS SHOWN BY CENTRAL TENDENCIES AND DISPERSIONS.

Since this investigation is primarily a study of the individual differences in reading ability, it is necessary to make rather careful observation of the central tendencies and dispersions. The central tendencies, shown in the different tables by the mean, give us some idea of the average performance of the group. The dispersions are indicated, first, by the range, which shows the upper and lower limits of the distributions; and second, by the standard deviations, which show the nature of the variation from the central tendency. The coefficient of variation, another measure of variability offers a better chance for comparison, since in each case it gives us the percentage that the standard deviation is of the mean score.

As stated in Chapter IV, a separate investigation was made of the fall and the winter groups and the results were treated separately. For this reason, there will be found for each test two sets of results.

The results from the different tests will now be presented in the following order:

1. Holley, Sentence Vocabulary Scale, Series 3 B
2. Whipple's High-School and College Reading Test, Form A and Form B.
3. Van Wagenen Reading Scales, General Science, Scale A
4. Van Wagenen Reading Scales, English Literature, Scale B
5. Four Special Tests Combined
6. Four Special Tests Treated Separately
7. Fact Comprehension for the Four Special Tests Combined
8. Fact Comprehension for Each of the Four Special Tests
9. Application of Facts for the Four Special Tests Combined
10. Application of Facts for Each of the Four Special Tests
11. Locating Principle for the Four Special Tests Combined

1. Holley's Sentence Vocabulary Scale

As stated in the definition of reading in Chapter I, reading varies from the comprehension of verbal symbols or words to the comprehension of long articles, highly

complex and technical, involving a high degree of reasoning. Word comprehension is not only a type of reading within itself, but also one of the chief elements in all other types of reading. Reading success seems to depend greatly on the ability of the reader to comprehend quickly, accurately, and fully the meaning of words.

Irion¹ found that "word knowledge seems to stand out as a very significant item in reading comprehension." He reports a correlation of .68 between word knowledge and reading comprehension in English literature by ninth grade students. He found also that the average word knowledge of the 170 subjects studied was only 57.5 per cent of the "pivotal" words in the selection studied.

In a study of the relationship between social-ethical vocabulary and native ability, Schwesinger² reports a correlation of .88. The same writer reports a correlation of .62 between social-ethical vocabulary and moral knowledge.

Terman finds a high relationship between word knowledge and intelligence. He states "Our statistics show that in a large majority of cases the vocabulary test alone will give us an intelligence quotient within 10 per cent of that secured by the entire scale."³ (Stanford Revision and Extension of the Binet-Simon Scale)

Because of the great significance of word knowledge as related to reading ability and as related to intelligence, which is also closely related to reading ability, we are including the results from Holley's Sentence Vocabulary Scale along with the results from the various reading tests. A summary of these results is given in Table 2.

TABLE 2
Summary of Results Based on the Holley Vocabulary Scale

	Range	Mean	S. D.	P. E. _m	V.
Fall	39	54.2	8.4	± .47	15.5
Winter	34	52.2	7.2	± .53	13.7

The preceding table shows the wide variation in knowledge of vocabulary as based on the Holley Vocabulary Scale. Out of a possible score of 70, there is a range from 70 to 31 or 39 points for the fall semester group and from 68 to 34 or 34 points for the winter semester group. The highest student for the two semesters knows two and a third times as many words as the lowest. The average for the highest fourth of the two groups is about 1.7 times that of the lowest fourth. One student knows all of the words in the list, while another student knows only 44 per cent. This wide variation in word knowledge has additional interest when it is known that the correlation between vocabulary and reading ability is high. The correlations between the Holley Vocabulary Scale and the various reading tests used in this study run from .43 to .71. The mean score for the two groups combined is about 76 per cent of the total possible score. In general, the performance of the two groups is similar. The average of the fall group is a little higher and the distribution a little wider. The curve of distribution for each of the two groups was fairly symmetrical, the one for the fall group being a little more skewed to the left.

2. Whipple's High-School and College Reading Test

As stated in Chapter II, our purpose in giving the Whipple test was to get a general idea of the unanalyzed reading ability of our subjects, in order to compare them with groups from other institutions and to have data for finding the relation-

¹Irion, Theo. W. H., *Comprehension Difficulties in the Study of Literature*, Teachers College, Columbia University Contributions to Education, Number 189, 1925, pp. 46-48, 72.

²Schwesinger, Gladys C., *The Social-Ethical Significance of Vocabulary*, Teachers College, Columbia University Contribution to Education, Number 211, 1926.

³Terman, Lewis M., *The Measurement of Intelligence*, 1916, p. 230.

ship between the abilities to read the different types of material as found in literature, general science, and educational psychology. A summary of the results of the Whipple test is given in Table 3.

TABLE 3

Summary of Results Based on Whipple's High School and College Reading Test

	Range	Mean	S. D.	P. E. _m	V.
Fall	13	11.1	2.98	$\pm .17$	26.8
Winter	13	11.2	2.77	$\pm .16$	24.8

Inspection of Table 3 shows that the performance of the fall and winter groups was almost identical. The fall group was slightly more variable. The distribution for the two groups were symmetrical, approaching a normal curve.

A very significant fact from the standpoint of this study is the exceptionally wide range in each case. Out of a possible 20 points, the range is from 18 to 5 inclusive or a difference of 13 points. This becomes more significant when it is remembered that in a given time and in a given selection the best readers in the class do 3.6 times as much as the poorest readers. Stated differently, it means that the highest fourth of the class can do about 2.5 times as much as the lowest fourth. Stated in a still different manner, a two-hour reading assignment for the highest fourth is equivalent to a five-hour assignment for the lowest fourth of the class.

From the standpoint of unanalyzed reading ability as measured by this test, our two groups seem to be about normal. The average is a little higher than the norms given by the author of the test and those reported by Sperle and Book. It should be remembered, however, that both Sperle and Book were measuring freshmen, while we were measuring upperclassmen. The range of our subjects was slightly less than that given by Sperle and Book.

3. Van Wagenen Reading Scales, General Science, Scale A

In connection with the Van Wagenen tests, we wished to study, first, individual differences as shown by dispersions; and second, correlations between the abilities to read different types of material. A summary of the results based on the Van Wagenen General Science Scale is given in Table 4.

TABLE 4

Summary of Results Based on the Van Wagenen General Science Reading Scale

	Range	Mean	S. D.	P. E. _m	V.
Fall	48	92.95	10.0	$\pm .56$	10.76
Winter	44	91.75	8.5	$\pm .60$	9.26

Inspection of Table 4 shows the distributions of the two groups to be again very similar. The mean for the fall group is 1.2 points higher and the distribution a little wider than for the winter group. The curve in each case was symmetrical, indicating that the material was sufficiently difficult to check even the best readers.

Here, again, the wide distribution is of interest. Out of a possible 115 points, the range in one case was 48 points and in the other 44 points.

The highest fourth of the two groups combined does 1.45 times as much as the lowest fourth. This becomes more significant when it is remembered that there was no time limit on this test. The slowest people had time to finish. The failure to make a perfect score is due to mistakes in reading and not to lack of time. The poorest

readers are at a great handicap since they have so much incorrect information mixed in with the correct. The best readers have practically all correct information.

The mean score of the two groups combined is about 80 per cent of the total possible performance. The poorest individuals made 60 per cent of the total possible score, while the best individuals made 100 per cent.

It might be noted here that on this test the highest fourth of the group does only 1.45 times as much as the lowest fourth, while on the Whipple test the highest fourth of the group did 2.5 times as much as the lowest fourth. This is probably accounted for by the fact that the Whipple test is a speed test, while the Van Wagenen tests are power tests in which the individual is given sufficient time in which to finish.

4. Van Wagenen Reading Scales, English Literature, Scale B

The purpose in giving the Van Wagenen English Literature Scale was the same as that for giving the General Science Scale. We were interested in the deviations from the central tendency and in the correlations with other types of reading material. The results based on the English Literature Scale are given in Table 5.

TABLE 5

Summary of Results Based on the Van Wagenen English Literature Reading Scale

	Range	Mean	S. D.	P. E. _m	V.
Fall	45	96.0	9.6	± .54	10.0
Winter	41	93.9	9.5	± .66	10.3

Observation of Table 5 shows the performance of the fall and the winter groups on the English Literature Scale to be very similar. The performance on the English Literature Scale is not greatly different from that on the General Science Scale. The winter group is a little more variable on the English Literature Scale.

Here again, attention is called to the wide distribution. The highest fourth does 1.4 times as much as the lowest fourth. Each student had time to complete the test, so that the low scores are again due to lack of ability to read and not to lack of time. The poorest students get approximately 60 per cent of the possible score, while the best students get 100 per cent. The mean score for the two groups is about 82 per cent of the possible performance. The poor student is confused by a large amount of incorrect information.

5. Four Special Tests Combined

It will be remembered that one of the chief objects of this study was to discover the actual performance of college students on the type of reading material assigned in educational psychology. The four Special Reading Tests were constructed for this purpose.

We are interested in both the central tendencies and the distributions. The central tendencies show the general performance of the groups. If we are to individualize instruction, however, we must know more than central tendencies; we must know just how the different individuals vary from the central tendencies. We need to know what proportional part of the group can get and apply all the facts in the reading material assigned. We need to know also the number and nature of the individuals who are unable to comprehend the major part of the material. The scores of the four Special Tests combined are treated here in order to get a comprehensive view of the total performance of the different students in reading material in educational psychology. The results from the four Special Tests are shown in Table 6.

TABLE 6

Distributions According to the Combined Scores of the Four Special Tests.

Score	Fall	Winter
80-85	0	2
85-90	3	2
90-95	1	3
95-100	3	4
100-105	3	2
105-110	6	6
110-115	10	6
115-120	12	5
120-125	17	12
125-130	10	12
130-135	19	14
135-140	16	10
140-145	14	7
145-150	11	5
150-155	12	2
155-160	8	0
Number	145	92
Range	72	74
Mean	130.5	123.8
S. D.	16.5	16.5
P.E. Mean	$\pm .9$	± 1.1
V.	12.4	13.3

Observation of Table 6 shows the performance of the two groups on the four Special Tests combined to be very similar. The mean for the fall group is 6.7 points higher than that for the winter group, otherwise the performance is almost the same. The distributions are fairly symmetrical, each having a slight tendency to pile up at the upper end.

The wide range in each group is significant. Out of a possible score of 164, there is a range for the two groups combined of 77 points, the highest score being 157 and the lowest score 80. The best students do twice as much as the poorest students. The best students get 157 points out of a possible 164, or practically all, while the poorest students get a little less than half of the total possible score. The average score of the two groups combined is a little less than 80 per cent of the total possible score. The mean of the highest fourth of the two groups combined is a little more than 1.5 times that of the lowest fourth. This is practically the same relationship as was found with the Van Wageningen tests, where the time was also not limited.

The above information shows the extremely wide variation in the ability of different college students to read material as found in educational psychology. A few students get the material with practically perfect comprehension, while others comprehend only about half. This probably means that the best students are not just twice as efficient as the poorest students, but that they are many times more efficient, since the information of the poorest students is so inaccurate as to be practically useless.

As the four Special Tests represent a good sampling of the material to be found in educational psychology, the total performance on these tests is indicative of the

student's ability to read educational psychology. These tests show beyond any doubt that all students do not read average material in educational psychology with equal ability, and that many students do not read it sufficiently well to comprehend ordinary assignments. The distributions show that average material as found in educational psychology is difficult enough to scatter the individuals into fairly symmetrical curves of distribution.

6. Four Special Tests Treated Separately

We have shown the distributions based on the scores of the four Special Tests combined. We shall now show the results as based on each of the four separate tests.

It will be remembered that the four Special Tests were constructed on the same general plan but that the reading material was deliberately varied in order to measure reading ability on different types of material as found in educational psychology.

Results from the four Special Tests treated separately are found in Tables 7 to 10 inclusive.

TABLE 7
Distributions According to Special Test Number I.

Score	Fall	Winter
17-19	1	0
19-21	3	0
21-23	2	1
23-25	4	1
25-27	8	8
27-29	7	10
29-31	14	14
31-33	17	14
33-35	22	13
35-37	23	13
37-39	24	14
39-41	15	4
41-43	5	0
Number	145	92
Range	24	19
Mean	33.6	32.7
S. D.	5.2	4.2
P. E. Mean	$\pm .29$	$\pm .3$
V.	15.7	12.8

TABLE 8
Distributions According to Special Test Number II

Score	Fall	Winter
17-19	0	2
19-21	0	2
21-23	3	1
23-25	0	4
25-27	5	4
27-29	4	1
29-31	7	3
31-33	13	4
33-35	18	16
35-37	22	20
37-39	31	18
39-41	29	10
41-43	13	7
Number	145	92
Range	22	25
Mean	36	34.6
S. D.	4.48	5.6
P. E. Mean	$\pm .25$	$\pm .39$
V.	12.4	15.2

TABLE 9
Distributions According to Special Test Number III

Score	Fall	Winter
17-19	1	0
19-21	1	0
21-23	1	0
23-25	2	2
25-27	2	7
27-29	2	4
29-31	17	6
31-33	14	7
33-35	29	20
35-37	29	27
37-39	25	12
39-41	19	7
41-43	3	0
Number	145	92
Range	26	16
Mean	34.8	34
S. D.	4.3	4.
P. E. Mean	$\pm .24$	$\pm .28$
V.	12.4	11.8

TABLE 10
Distributions According to Special Test Number IV

Score	Fall	Winter
7-9	0	2
9-11	0	2
11-13	0	2
13-15	8	6
15-17	7	6
17-19	4	5
19-21	7	6
21-23	8	9
23-25	14	12
25-27	18	11
27-29	15	8
29-31	21	9
31-33	15	6
33-35	10	4
35-37	8	3
37-39	9	1
39-41	1	0
Number	145	92
Range	27	29
Mean	27.3	23.
S. D.	6.5	6.9
P. E. Mean	$\pm .36$	$\pm .48$
V.	23.8	29.0

In Table 11 will be found a summary of the four immediately preceding tables which give the central tendencies and distributions for the four separate Special Tests for the fall and the winter groups.

TABLE 11
Summary of Results Based on the Four Separate Special Tests

		Range	Mean	S. D.	P. E. m	V.
I.	Fall	24	33.6	5.2	$\pm .29$	15.7
	Winter	19	32.7	4.2	$\pm .30$	12.8
II.	Fall	22	36.0	4.5	$\pm .25$	12.4
	Winter	25	34.6	5.6	$\pm .39$	15.2
III.	Fall	26	34.8	4.3	$\pm .24$	12.4
	Winter	16	34.0	4.0	$\pm .28$	11.8
IV.	Fall	27	27.3	6.5	$\pm .36$	23.8
	Winter	29	23.8	6.9	$\pm .48$	29.0

Inspection of Tables 7 to 11 inclusive shows a great similarity of performance for the fall and the winter groups on each of the four Special Tests. The curves of distribution for the two groups on each of the four tests are of the same general shape.

The means for the two groups of each of the four tests show no wide variations. The greatest variation is a difference of three and a half points, when the winter group dropped on Test IV. The coefficients of variation show that there is no great difference in the variability of the two groups on each of the tests, except on Test IV in which the winter group is considerably more variable than the fall group. There is no great variation in the ranges of the two groups with the exception of Test III, in which the fall group has a range of 26 points while the winter group has a range of only 16 points.

With the exception of the variations mentioned, the performance of the fall and the winter groups is similar.

We shall now observe the results of varying the material in the different tests. Inspection of the means of the four tests shows no significant differences for the first three; however, the means of Test IV are considerably lower, being approximately seven points lower for the fall group and ten points lower for the winter group.

There seems to be nothing consistent or significant in the variability as shown by the ranges of the four tests except that they are all wide. If we observe the coefficients of variability, which are more comparable, we find no great differences except in Test IV, in which the variability is from two to two and a half times as great as that of any of the other three tests. The variability on each of the tests is wide enough to indicate rather extreme individual differences in reading ability.

Varying the type of material seems to make no difference in the total performance of the subjects except in Test IV. There is the same consistent, wide variation in each of the tests, emphasized in Test IV. The average performance, as indicated by the means, is about the same for the first three tests, but lower for Test IV. It will be remembered that Test IV was based on complex material with conflicting opinions involving different theories of transference of training. Results indicate that this material was beyond the comprehension of a large number of individuals. We notice, too, that the winter group fell lower and was more variable than the fall group on Test IV. This is no doubt due to the fact that the winter group had not had the advantage of class discussions and lectures on the general subject of transfer of training. This may indicate that a preliminary discussion in taking up a new and difficult problem may be particularly valuable in helping the student to read technical and complex material.

7. Fact Comprehension for the Four Special Tests Combined

We shall now examine the performance on the separate elements of the Special Tests. In Table 12 are shown the results based on Fact Comprehension for the Four Special Tests combined. Inspection of Table 12 shows the performance of the two groups to be practically identical in Fact Comprehension for the four Special Tests combined.

The variability is again wide as was true with all the preceding distributions. The range for the two groups combined is from 39 to 17, or 22 points out of a possible score of 40. The poorest students get fewer than half the facts, while the best students get 39 out of a possible 40. Combining the two groups, the mean of the lowest fourth is about 62 per cent of the total possible score; the mean for the middle half is 75 per cent of the possible score; and the mean for the highest fourth is 92 per cent of the possible score. The mean for the highest fourth is again approximately 1.5 times that for the lowest fourth.

TABLE 12

Distributions According to Fact Comprehension of the Four Special Tests Combined.

Score	Fall	Winter
16-18	0	2
18-20	4	1
20-22	4	2
22-24	6	3
24-26	7	6
26-28	16	9
28-30	19	13
30-32	13	12
32-34	19	21
34-36	21	12
36-38	25	10
38-40	11	0
Number	145	92
Range	21	21
Mean	31.05	30.24
S. D.	5.2	4.7
P. E. Mean	$\pm .29$	$\pm .33$
V.	16.5	15.5

Attention should be called to the piling up of scores at the upper end of the distribution, which indicates that the material is well within the capacity of the best students; however, there are a number of individuals at the lower end of the distribution who get only about 50 per cent of the total facts.

It should be remembered that the student had the reading material before him and could refer to it as often as he desired. He also had sufficient time in which to finish the test. A low score is due to the lack of comprehension and not to the lack of time.

8. Fact Comprehension for Each of the Four Special Tests

We have shown the performance on Fact Comprehension for the four Special Tests combined. We shall now show in summary form in Table 13 the performance on Fact Comprehension for each of the four tests taken separately.

TABLE 13

Summary of Results Based on Fact Comprehension for Each of the four Special Tests

		Range	Mean	S. D.	P. E.m	V.
I.	Fall	7	7.95	1.90	$\pm .11$	22.3
	Winter	7	7.78	1.60	$\pm .11$	20.6
II.	Fall	8	7.84	1.66	$\pm .09$	19.9
	Winter	7	7.73	1.55	$\pm .11$	19.8
III.	Fall	9	8.00	1.50	$\pm .08$	17.6
	Winter	7	7.85	1.57	$\pm .11$	20.0
IV.	Fall	7	7.24	1.60	$\pm .09$	20.8
	Winter	7	6.90	1.50	$\pm .10$	23.2

Inspection of Table 13 shows the results to be practically identical for the fall and the winter groups. The winter group is a little lower on the mean score in each of the four tests. The wide variability is seen in the performance of each group, as indicated by the coefficients of variability and the ranges.

If we observe the performances on the four different tests, we find no significant differences, indicating that as far as fact comprehension is concerned, varying the type of material made little difference. The mean dropped slightly in Test IV, but not nearly as much in proportion as was found for the corresponding scores on the whole of Test IV. This indicates that the low scores on Test IV are due not so much to poor Fact Comprehension as to poor Application of Facts.

A significant fact in the results based on Fact Comprehension is the wide range in each case. Out of a possible score of 10 on each test, there is a difference of from 7 to 9 points between the highest and lowest scores.

There was a tendency for the scores to pile up at the upper end of the distribution on each test, indicating that the material was not difficult enough to scatter the best students. The fact remains, however, that many students were so poor in comprehension that the distributions covered almost the whole possible range, several students getting less than 30 per cent of the facts possible.

9. Application of Facts for the Four Special Tests Combined

As previously stated, we desired to treat Fact Comprehension and Application of Facts separately in part of our results for two reasons: first, we desired to study the individual differences in the ability of students to apply facts; and second, we wanted to find the correlation between the ability to comprehend facts and the ability to apply facts.

The scores on Application of Facts, as treated in this section, do not include the scores made on locating the principle, as it was desired to make the analysis as fine as possible. Locating the Principle for the four Special Tests combined will be treated in a later section.

It will be remembered that each of the four Special Tests contained 16 true-false statements involving the application of the facts in the reading material to educational problems or practices. As far as possible, the problems were arranged in pairs so that there was a double check on each principle applied. The score used in Application of Facts was the number of correct applications.

The results based on Application of Facts will be taken up in the same relative order as was used in presenting the results for Fact Comprehension. The results based on Application of Facts for the four Special Tests combined will be found in Table 14.

Examination of Table 14 shows the performance of the two groups to be again very similar; however, the winter group is a little more variable and has a slightly lower mean.

We find a wide variation as usual. The range for the fall group is 36 and for the winter group is 31 out of a possible 64 points. Combining the two groups, the lowest score is 27 and the highest is 63. The lowest people get approximately 50 per cent, the average people 80 per cent, and the highest people 100 per cent of the total possible score. These scores, as used in this section, give only the relative standing and not the actual per centage of applications made, since the wrongs were not subtracted from the rights. The upper scores would remain practically the same, however, since they are nearly perfect. The lowest scores would drop, making the mean somewhat lower and the range considerably wider.

TABLE 14
Distributions According to the Application of Facts for the Four Special Tests Combined

Score	Fall	Winter
26-29	1	0
29-32	1	2
32-35	0	1
35-38	0	2
38-41	1	6
41-44	6	6
44-47	9	4
47-50	14	12
50-53	31	19
53-56	32	22
56-59	24	14
59-62	19	4
62-64	7	0
Number	145	92
Range	36	31
Mean	54.2	50.5
S. D.	6.	6.75
P. E. Mean	$\pm .34$	$\pm .47$
V.	11.1	13.3

10. Application of Facts for Each of the Four Special Tests

We shall now take up the Application of Facts for each of the four Special Tests separately, in order to find if the groups apply facts from different types of material in educational psychology equally well.

A summary of the results based on Application of Facts for each of the four Special Tests will be found in Table 15.

TABLE 15
Summary of Results Based on Application of Facts for Each of the Four Special Tests

		Range	Mean	S. D.	P. E.m	V.
I	Fall	7	14.0	1.8	$\pm .10$	12.4
	Winter	7	13.6	1.7	$\pm .11$	12.4
II	Fall	12	14.5	1.7	$\pm .10$	11.3
	Winter	10	13.8	2.4	$\pm .16$	17.4
III	Fall	9	13.5	1.6	$\pm .09$	10.7
	Winter	7	13.2	1.4	$\pm .10$	10.6
IV	Fall	14	11.0	3.1	$\pm .17$	28.2
	Winter	13	8.7	3.4	$\pm .24$	38.9

Inspection of Table 15 shows again the great similarity of performance for the fall and the winter groups. There is no significant difference for the two groups except for Test IV in which the mean is lower and the coefficient of variability greater for the winter group. As has already been pointed out, this is probably due to the fact that the winter group had not had the advantage of the lectures and class discussions on the general subject of transfer of training.

Now we shall see the effect on the Application of Facts of varying the type of material. Examining the results from the four Special Tests, we find that the means for Tests I, II, and III are all within the range 13.2—14.5. The means for Test IV, however, drop to 11.0 for the fall group and 8.7 for the winter group, showing that students have great difficulty in applying abstract technical material involving judgment and discrimination. It will be remembered that there was some decrease in Fact Comprehension on Test IV, but this decrease was not nearly as great in proportion as the decrease shown in Application of Facts.

The coefficients of variability are fairly constant except for Test IV, in which they are much greater. Increasing the complexity of the material seems to increase the variability on Application of Facts. The ranges are greatest for Tests II and IV, those for Test IV being practically twice those for Tests I and III. The ranges for the four tests vary from 7 to 14 out of a possible 16 points.

We find a wide range of individual differences in the ability of different students to apply facts from educational psychology to educational problems and practices. These individual differences remain fairly constant for application of facts from the material found in the first three tests, but increased greatly with the complex type of material as found in Test IV.

TABLE 16

Distributions According to Locating of Facts for the Four Special Tests Combined

Score	Fall	Winter
11-14	0	1
14-17	0	0
17-20	0	0
20-23	1	1
23-26	2	0
26-29	1	1
29-32	2	4
32-35	5	5
35-38	9	5
38-41	10	12
41-44	24	12
44-47	20	19
47-50	23	12
50-53	17	11
53-56	19	8
56-59	11	1
59-62	1	0
Number	145	92
Range	40	47
Mean	46.2	43.7
S. D.	7.6	6.3
P. E. mean	$\pm .43$	$\pm .44$
V.	16.43	14.4

11. Locating of Facts for the Four Special Tests Combined

The results based on Locating of Facts for the four Special Tests combined are found in Table 16.

Inspection of Table 16 shows that the distributions for Locating of Facts or Principles for the four Special Tests combined are of the same general type as those of Fact Comprehension and Application of Facts for the four Special Tests combined.

Here again, the range is wide, that for the fall group being 40 and that for the winter group being 47 out of a possible 64 points. If we combine the two groups, we find that the range is from 60 to 11, or 49 points.

For the two groups combined, the average performance is 71 per cent of the total possible performance. The best students locate 94 per cent of the principles correctly, while the poorest students locate only 17 per cent.

B. THE NATURE OF INDIVIDUAL DIFFERENCES IN READING ABILITY AS SHOWN BY CORRELATIONS.

It is our purpose to study in this section the nature of individual differences in reading ability as shown by correlations. What is the correlation, for instance, between reading ability and intelligence? What is the relationship between reading ability and word knowledge? What is the correlation between the abilities to read different types of material? What is the correlation between the abilities to read different types of material as found in educational psychology? What is the relationship between the ability to read material in educational psychology and scholarship in the course?

The fall and the winter groups are treated separately since it is believed that separate treatment will give more significant results. In reality, there are two separate studies, one study acting as a check on and emphasizing the results found in the other. Each group has enough subjects to make the correlations significant, there being 145 people in the fall group and 92 people in the winter group.

In the different tables, the first set of correlations refers to the fall semester group while the second set refers to the winter semester group.

1. Correlations of Otis Mental Tests with the Holley Vocabulary Scale and the Various Reading Tests

TABLE 17
Correlations of Otis Mental Tests with Other Tests

	Otis	mental	Tests
Holley Vocabulary Scale	.63	± .03	
	.57	± .05	
Whipple's Reading Tests	.67	± .03	
	.68	± .04	
Van Wagenen Reading Scale, General Science	.62	± .04	
	.55	± .05	
Van Wagenen Reading Scale, Literature	.61	± .04	
	.57	± .05	
Fact Comprehension, Special Tests	.66	± .03	
	.70	± .04	
Application of Facts (Location Included), Special Tests	.66	± .03	
	.72	± .03	
Total of Special Tests	.69	± .03	
	.66	± .04	

Since intelligence seems to be such an important factor in determining individual differences, we give in Table 17 the correlations of intelligence as measured by the Otis Mental Tests with the Holley Vocabulary Scale and the various reading tests used in this study.

The correlations in Table 17 are all positive and high enough to be significant. There is great uniformity among the correlations of the Otis Mental Tests with the various other tests. They are all between .55 and .72, General Science with Otis being lowest and Application of Facts with Otis being highest. The correlations of Otis with the two elements and total of the Special Tests are about the same as Otis with Whipple and slightly higher than Otis with all of the other tests. The correlation of Otis with Holley Vocabulary Scale is higher than that of Otis with the Van Wagenen reading tests.

The correlations show that there is a very close relationship between mental ability, as measured by the Otis Mental Tests, and the ability to read, as measured by both the standardized reading tests and the Special Reading Tests. The correlations here are high enough to indicate that lack of ability in reading may be due to lack of mental capacity in some cases. On the other hand, it is very possible that the score on the Otis Mental Tests is influenced to no little degree by the ability to read. Both the Otis Mental Tests and the various reading tests used in this study are based largely on verbal reactions.

Evidently the ability to comprehend facts and to apply facts bear about the same relationship to mental ability.

2. Correlations of Holley Vocabulary Scale with the Various Reading Tests

As previously stated, word knowledge seems to be one of the chief factors in reading ability. Since this is true, we desired to find the correlation between word knowledge, as measured by the Holley Vocabulary Scale, and the various reading tests used in this study. The coefficients of correlation are given in Table 18.

TABLE 18
Correlations of Holley Vocabulary Scale with Various Reading Tests

	Holley Vocabulary	
Whipple's Reading Tests	.61	± .04
	.71	± .03
Van Wagenen (General Science)	.53	± .04
	.43	± .06
Van Wagenen (Literature)	.53	± .04
	.60	± .05
Special Tests, Combined	.64	± .03
	.60	± .05

Inspection of the above table shows that there is a high correlation between word knowledge, as measured by the Holley Vocabulary Scale, and the various reading tests. The correlations range from .43 for Vocabulary with General Science in the winter semester group to .71 for Vocabulary with Whipple's Reading Tests in the winter semester group. Word knowledge correlates highest with the Special Tests and with Whipple's Reading Tests.

Since word knowledge correlates so highly with reading ability, it may be worth while to give special drill in the acquiring of a reading vocabulary. Not only is it necessary to have a general reading vocabulary, but also a technical vocabulary in the particular course studied.

In general, there is a similarity between the correlations made by the fall and the winter groups. They are not as uniform however, as those found with the Otis scores.

3. Correlations Between the Different Reading Tests

We desired to find, among other things, the correlations between the abilities to read different types of material. If an individual is good in reading one type of material, is he good in reading all other types, or may he be good in reading one type of material and poor in reading another type? To what extent is there a general reading ability, and to what extent is reading specific, being a different process for each type of material? To what extent is it possible to judge a student's reading ability in a specific subject by the use of a general reading test? A study of the correlations between different types of reading material should throw some light on these questions. The coefficients of correlation for the different reading tests used in this study are given in Table 19.

TABLE 19
Correlations Between the Different Reading Tests

	Whipple	Science	Literature	Special
Whipple		.51±.04 .47±.05	.52±.04 .58±.05	.63±.03 .62±.04
Science	.51±.04 .47±.05		.50±.04 .48±.05	.58±.04 .56±.05
Literature	.52±.04 .58±.05	.50±.04 .48±.05		.57±.04 .51±.05
Special	.63±.03 .62±.04	.58±.04 .56±.05	.57±.04 .51±.05	

Inspection of Table 19 shows that the correlations between the different reading tests are much the same for both the fall and the winter groups, the greatest difference being .06.

The correlations between the different reading tests are all positive and fairly high, ranging from .47 to .63. This indicates that up to a certain point the reading of different types of material requires the same or closely related abilities. Beyond this point, the reading of different types of material is a fairly specific process. In other words, the ability to read one type of material well does not necessarily mean that an individual will read another type with the same degree of perfection. This would indicate that individuals need to have special training in reading different types of material.

It should be remembered, however, that a correlation of .5 or .6 is high enough to indicate that the reading performance in one type of material is likely to be similar to the performance in other types of material. This means that it is possible to measure approximately the abilities to read different types of material with the same test; however, to get more accurate results, it is necessary to have a specific reading test built for a specific type of reading material.

It will be noticed that the highest correlation is between Whipple and the Special Tests, while the lowest is between Whipple and General Science.

4. Correlations of Whipple's Reading Tests with Special Tests

We desired to find to what extent the performance on a general standardized reading test, such as Whipple's reading test, is indicative of the ability to read different types of material as found in educational psychology. For this reason, we calculated the coefficients of correlation between the Whipple test and the different Special Tests. The results are shown in Table 20.

TABLE 20
Correlations of Whipple's Reading Tests with Special Tests

	Whipple's Reading Test
Test I, Economical Learning	.57 ± .04 .53 ± .05
Test II, Individual Differences	.59 ± .04 .51 ± .05
Test III, Influence of Conditions	.53 ± .04 .52 ± .05
Test IV, Transference of Training	.53 ± .04 .47 ± .05
Four Special Tests Combined	.63 ± .03 .62 ± .04

Inspection of Table 20 shows a fairly high correlation between the Whipple test and each of the Special Tests. The lowest correlation is .47 for the winter semester group on Test IV, and the highest is .59 for the fall group on Test II. The correlations between Whipple and the four Special Tests combined are .63 and .62. The range of correlations is small. The correlations between Whipple and the Special Tests are similar for the fall and the winter groups.

5. Correlations of Whipple's Reading Test with Total Fact Comprehension and Total Application of the Special Tests

Having found the correlations between the Whipple test and the different Special Tests, we desired to find next the relationship between the Whipple test and total Fact Comprehension of the Special Tests, and between Whipple and total Application of Facts of the Special Tests. Total Application of Facts, as used in this section, includes also the Location of Facts or Principles. The correlations are given in Table 21.

TABLE 21
Correlations of Whipple's Reading Test with Total Fact Comprehension and Total Application of Facts of the Special Tests

	Whipple's Reading Test
Total Fact Comprehension	.60 ± .04 .61 ± .04
Total Application of Facts	.60 ± .04 .58 ± .05
Fact and Application Combined	.63 ± .04 .62 ± .04

Inspection of Table 21 shows that the correlations between Whipple's reading test and total Fact Comprehension of the Special Tests are .60 and .61; those between Whipple and total Application of Facts are .60 and .58; and those between Whipple and Fact Comprehension and Application of Facts combined are .63 and .62. The similarity of the six coefficients is striking. The coefficients for the fall and the winter groups in each case are practically the same, as are the coefficients for total Fact Comprehension with Whipple, total Application of Facts with Whipple and Fact and Application combined with Whipple. Evidently there is a close relationship among the different processes involved.

It might be noted here that the correlation between total Fact Comprehension and total Application of Facts, Location of Principle included, is $.67 \pm .03$ for the fall semester group and $.63 \pm .04$ for the winter semester group. This indicates that the people who are good in Fact Comprehension are likely to be good in the Application of Facts. This might be expected since Fact Comprehension and Application of Facts are based largely on the process of recognizing certain relationships. Fact Comprehension involves seeing certain relationships between verbal symbols and informational background, while Application of Facts involves seeing relationships between certain principles and problems based on these principles.

6. Correlations Between the Different Special Tests

The purpose in this section is to discover the correlations between the abilities to read different types of material found in educational psychology. It was desired to find out to what extent the relative reading performance of the different individuals remains constant for different types of material in educational psychology. The correlations are given in Table 22.

TABLE 22
Correlations Between the Different Special Tests

	Test I	Test II	Test III	Test IV
Test I		$.54 \pm .04$ $.58 \pm .05$	$.50 \pm .04$ $.57 \pm .05$	$.53 \pm .04$ $.47 \pm .05$
Test II	$.54 \pm .04$ $.58 \pm .05$		$.56 \pm .04$ $.70 \pm .04$	$.47 \pm .05$ $.45 \pm .06$
Test III	$.50 \pm .04$ $.57 \pm .05$	$.56 \pm .04$ $.70 \pm .04$		$.56 \pm .04$ $.56 \pm .05$
Test IV	$.53 \pm .04$ $.47 \pm .05$	$.47 \pm .05$ $.45 \pm .06$	$.56 \pm .04$ $.56 \pm .05$	

Inspection of Table 22 shows that the correlations between the different Special Tests are rather uniform and fairly high. They range from .45 to .70 with ten out of the twelve falling between .47 and .58 inclusive. It might be noted that the lowest coefficients of correlation are those between Test II and Test IV. Test II was based on material of the simple expository type, while Test IV was based on material of a complex, technical nature, involving judgment.

While the correlations are fairly high, they are low enough to show that the relative performance on different types of material in educational psychology is by no means constant; in fact, the relative performance in reading different types of

material found in educational psychology may differ quite as much as the performance in reading material found in two entirely different subjects, as English Literature and educational psychology.

It should be remembered that each of the Special Tests was deliberately built on a different type of material as found in educational psychology.

It will be noted that the inter-correlations shown in Table 22 are much lower than the self-correlations for the different tests given in Table 1. The self-correlations for the different tests vary from .76 to .92. This shows that there is not a general reading ability for even a single subject, but that the process varies considerably with the type of material found within the subject.

7. Correlations Between the Different Elements of the Special Tests.

Not only was it desired to find the correlations between the different Special Tests, but it was also desired to find the relationships between the different elements of the Special Tests. For this purpose, we took the total Fact Comprehension, the total Application of Facts, and the total Location of Principles of the Special Tests and correlated them with each other. These correlations are given in Table 23.

TABLE 23
Correlations Between Different Elements of Special Tests

	Fact Comprehension	Application of Facts	Location of Principle
Fact Comprehension		.62±.03 .66±.04	.68±.03 .66±.04
Application of Facts	.62±.03 .66±.04		.70±.03 .73±.03
Location of Principle	.68±.03 .66±.04	.70±.03 .73±.03	

Inspection of Table 23 shows that the correlations between the different elements of the Special Reading Tests are high. The individuals who are able to comprehend facts are likely to stand relatively high in the application of facts and in the ability to see the relationship between a problem and the principle involved as indicated by the performance in Location of Principle. The correlations between Application of Facts and Location of Principle are particularly high, being .70 for the fall semester group and .73 for the winter semester group.

It is interesting to note that the correlations between the different elements of the Special Tests combined are higher than the inter-correlations between the different tests, but are yet lower than the self-correlations of each of the Special Tests.

8. Correlations of Scholarship in Educational Psychology with Each of the Different Reading Tests

We desired to find the relationship between scholarship in educational psychology and the different reading tests since reading is one of the chief means of gaining information in such a course. As previously stated, scholarship was determined by the total of the scores made on the regular tests and examinations given by the instructor. These tests and examinations were all objective in nature. Scholarship, as used here, did not include scores made on any of the Special Reading Tests.

The tests and examinations on which scholarship was based were similar but not exactly the same for the two semesters. In Table 24 are shown the correlations of scholarship in educational psychology with each of the different reading tests.

TABLE 24
Correlations Between Scholarship in Educational Psychology and the Different Reading Tests

	Scholarship
Four Special Tests Combined	.73±.03 .65±.04
Whipple's Reading Test	.51±.04 .39±.06
Van Wagenen Science Scale	.45±.05 .36±.06
Van Wagenen Literature Scale	.51±.04 .35±.06

The coefficients found in Table 24 are all positive and high enough to be significant. The correlations of scholarship with the Special Tests are the highest, showing that the performance on the Special Tests is the best indication of scholarship in the course. The coefficients for the two groups are the same in relative standing with the exception of the Science Scale which for the winter semester group correlates one point higher than the Literature Scale. All the coefficients for the winter semester group are lower than the corresponding coefficients for the fall semester group.

9. Correlations of Special Tests with Each of the Other Tests

For purposes of convenience and reference, we show in one table all the correlations of the Special Tests combined with each of the other tests used in this study. These correlations are given in Table 25.

TABLE 25
Correlations of Special Tests with Each of the Other Tests

	Special Tests
Otis Mental Tests	.69±.03 .66±.04
Whipple's Reading Test	.63±.03 .62±.04
Van Wagenen Science Scale	.58±.04 .56±.05
Van Wagenen Literature Scale	.57±.04 .51±.05
Holley Vocabulary Scale	.64±.03 .60±.05
Scholarship in Educational Psychology	.73±.03 .65±.04

Inspection of Table 25 shows that the Special Tests combined correlate high with each of the standardized tests and with scholarship in the course. The correlations range from .51 to .73. The coefficients of correlation for the two groups are very similar, being a little lower in each case for the winter group. The different

correlations have already been discussed in preceding sections; however, we might call attention again to the high relationship between the ability to read material in educational psychology and intelligence. The Special Tests correlate to a fairly high degree with each of the standardized reading tests and with the Holley Vocabulary Scale. The high correlation between the Special Tests and scholarship in educational psychology shows that the ability to read material in educational psychology is one of the best indications of ability to do good work in the course.

10. Other Relationships

Careful analysis was made to discover to what extent individuals who score in the highest or the lowest fourth of the class on one of the Special Tests have a tendency to score in the same quartile on the other three Special Tests.

It was found that a student scoring in the highest or the lowest fourth on one test seldom scores in the other extreme on any of the other three tests, there being only 23 people out of a possible 237 who did this, out of the possibilities offered by each individual in the class taking four tests. In these 23 cases, there was no student who scored in the highest fourth on two tests and in the lowest fourth on the other two tests.

There were 12 people who scored in the highest fourth on all four tests as compared with 18 people who scored in the lowest fourth on all four tests; and 22 people who scored in the highest fourth on three tests and in the middle half on the other test as compared with 18 people who scored in the lowest fourth on three tests and in the middle half on the other test.

In general, it can be said that an individual scoring in the highest fourth on as many as two tests very seldom goes as low as the lowest fourth on either of the other two tests or vice versa. It should be pointed out that the individual who scores in the highest or the lowest fourth on only one test probably normally belongs in the middle half.

The evidence shows that, while there is no certainty that a student scoring in the highest or the lowest fourth on any one test will also score in that fourth on all the other tests, there is a tendency for a student to stay within fairly well-defined bounds in relation to the rest of the class.

C. INDIVIDUAL DIFFERENCES IN READING ABILITY AS INFLUENCED BY VARIOUS FACTORS.

We have made a rather detailed study of individual differences in reading ability as shown by central tendencies and distributions, and also of the nature of these individual differences as indicated by correlations. We shall now attempt to discover to what extent individual differences in reading ability are influenced by sex, age, and other factors. This must be done in order that we may know whether or not it is necessary to differentiate instruction on the basis of such factors.

As previously stated, part of the information used in this section was obtained from the questionnaires filled out by the students. We believe that this information is reliable because of the care used in constructing, administering, and filling out of the questionnaires.

The data for this part of the investigation were treated in three separate sections corresponding to the three divisions of the 237 subjects made for lecture purposes. Section I referred to the group of 78 people in the fall semester, Section II to the group of 67 people in the fall semester, and Section III to the group of 92 people in the winter semester.

Due to the necessity for condensing the original manuscript for purposes of publication, we are giving only the results for the three sections combined.

1. Individual Differences in Reading Ability as Influenced by Sex

Since sex is usually considered as one of the chief factors determining individual differences in people, comparisons were made of the reading ability of men and women on the Whipple Reading Test and on the Special Tests.

We find that the women average slightly higher than the men on the Whipple test. The average for the 66 men in the three sections combined was 10.8 while the average for the 171 women was 11.3, the women averaging .5 of a point higher or 4.6%. The slightly higher average score of women is noted also by Book who, in the investigation mentioned in Chapter I, reports that freshman boys average 10.2 on the Whipple test while freshman girls average 10.65.

There was practically no difference in the average scores of men and women on the Special Tests. The women are again, as on the Whipple test, a little in the lead, being 1.36 points higher than the men. The 66 men average 126.24 while the 171 women average 127.8. The average for both men and women combined, 237 cases, is 127.4.

From the evidence presented, we find that the women average a little higher than the men in reading ability as measured by both the Whipple Reading Test and the Special Reading Tests. This difference is too small, however, to be of any significance in providing for individual differences in instruction.

2. Individual Differences in Reading Ability as Influenced by Age

Since maturity is one of the chief causes of individual differences, it seemed to be worth while to find out to what extent the reading ability of college students is influenced by age. We were also interested in the influence of age on reading ability because of the rather popular opinion that older people do not learn as readily as younger people. This problem is growing in importance with the tendency toward continuation schools and adult education.

Because of the close relationship between intelligence and reading ability, we have included the Otis I. Q. 's of the different age groups in the table with the scores of the Whipple Reading Test and the Special Tests. Table 26 shows the average scores of the different age groups on the basis of these three tests.

TABLE 26
Average Scores of Different Age Groups on Basis of Otis Mental Tests, Whipple's Reading Test, and Special Tests

Age in Years	No of Cases	Otis I. Q.	Whipple Test	Special Tests
19 and less	36	120.9	12.1	134.3
20	68	115.6	11.8	129.3
21	50	111.4	10.2	121.0
22	32	113.3	10.6	124.9
23	23	111.7	10.6	126.7
24 and over	28	112.6	10.8	127.1
Combined	237	114.4	11.2	127.4

Inspection of Table 26 shows that the students in the age group 19 and less score highest on all three tests. Students 20 years of age come second in all three tests. A rather pronounced drop in all three tests occurs with the group of students 21 years of age. Beginning with age 22 and going on up to 24 years and over, there is a progressive increase in all three tests with the single exception of the Otis I. Q. for the age 22, which is slightly higher than for the ages 23 and 24. It should be noticed,

however, that, although there is this progressive increase from age 22 up, the scores in no age group and in no test ever are as high as those for age 19 and age 20.

The higher reading scores for the ages 19 and 20 may be explained in part by the higher intelligence of these students as indicated by the Otis I. Q. It should be noticed that the people 24 years of age and over score slightly higher in the reading tests than any of the other age groups except 19 and 20. It is possible that these people, 24 years of age and over, are slightly selected, due to the fact that only the more capable undergraduates of this age return to college.

The most significant fact to be derived from a study of this table is that age, within the limits found here, seems to make very little difference in the ability of college students to read. It is not necessary, therefore, to differentiate instruction for the purpose of providing for individual differences in the reading ability of college students on the basis of age.

3. Individual Differences in Reading Ability as Influenced by Social Status

It has been found that school children differ according to the social status of their parents. The intelligence of men in service during the World War was found to vary considerably with the different occupational groups. If these differences occur, it is logical to suppose that there might be differences in the reading ability of college students due to their social status. In Table 27 are shown the average scores of students whose fathers belonged to the different occupational groups on the Otis Mental Tests, the Whipple Reading Test, and the Special Reading Tests.

TABLE 27
Average Scores According to Social Status on Otis Mental Tests, Whipple's Reading Test, and Special Tests

Social Status	No. of Cases	Otis I. Q.	Whipple Test	Special Tests
Farmer	73	112.9	10.7	125.8
Professional	44	114.9	11.2	127.4
Business	75	113.3	11.2	127.7
Miscellaneous	32	118.6	12.3	132.8

Inspection of Table 27 shows that the farmer group scores the lowest in all three tests, the professional and the business groups score next with approximately the same standing, and the miscellaneous group scores the highest in all three tests. This consistent uniformity in relative ranking of the four occupational groups should be noted.

The miscellaneous group, which scores the highest in all three tests, consists of skilled laborers, salesmen, clerical workers, railway employees, and state officials. This group is 5 per cent higher than the lowest or farmer group on the Otis tests, 15 per cent higher on the Whipple test, and 5.6 per cent higher on the Special Tests.

Although the average scores of the different occupational groups vary in all three tests, these differences are comparatively small. The significant fact to be noted is not that the four groups differ slightly but that they are so much alike. Since the differences are so slight, there would be no necessity for any differentiation in instruction for the purpose of providing for individual differences in reading ability due to social status.

4. Individual Differences in Reading Ability as Influenced by Year in College

Comparisons were made of the reading ability of Sophomores, Juniors, and Seniors. The results are summarized in Table 28.

TABLE 28

Average Scores According to Year in College on the Basis of the Whipple Reading Test and Special Tests

Year in College	Number of Cases	Whipple Test	Special Tests
Sophomores	40	10.4	122.35
Juniors	151	11.1	127.0
Seniors	46	11.7	132.8
Combined	237	11.2	127.4

It will be noticed from an inspection of Table 28 that the average scores on the Whipple test become progressively higher in the order of Sophomores, Juniors, and Seniors. The Juniors are 6.7 per cent higher than the Sophomores, while the Seniors are 5.4 per cent higher than the Juniors. The Seniors are 12.5 per cent higher than the Sophomores.

This same progressive increase is noticed also on the Special Tests. The Juniors are 3.8 per cent higher than the Sophomores, the Seniors are 4.6 per cent higher than the Juniors, while the Seniors are 8.6 per cent higher than the Sophomores.

While these differences are fairly significant, they are not great enough to justify the differentiation of instruction on the basis of year in college alone. It must be remembered that the range between the highest and the lowest people in any one of the classes is many times greater than the difference between the averages of any two classes. While the average performance of the Sophomores is considerably below that of the Seniors, the best Sophomores are much better in reading ability than the poorest Seniors.

5. Individual Differences in Reading Ability as Influenced by School or College of Enrollment.

Comparisons were made to determine whether or not the individual differences in the reading ability of college students seemed to be influenced in any way by the students' line of specialization, as indicated by the school or college of enrollment. Our results showed some rather striking differences in reading ability among students from the eight different schools or colleges represented; however, the number of students represented in each division was too small in all but two cases to be the basis of any conclusive judgment of the reading ability of students from those divisions. We have, therefore, combined into one group the students from all divisions except Education and Arts and Science. This makes three groups with sufficient numbers in each for purposes of comparison. In Table 29 are given the summarized results.

TABLE 29

Average Scores According to School or College of Enrollment on the Whipple Reading Test and the Special Tests

School or College of Enrollment	Number of Cases	Whipple Test	Special Tests
Education	100	11.6	130.0
Arts and Science	83	11.4	127.9
Other Schools Combined	54	10.3	121.7
Combined	237	11.2	127.4

Inspection of Table 29 shows that on both the Whipple test and the Special Tests the three groups have the same relative ranking, Education scoring highest, Arts and Science second, and Other Schools Combined lowest. The average score of the Education group is 12 per cent higher than that of the lowest group, Other Schools Combined, on the Whipple test, and 6 per cent higher on the Special Tests. The Education students are but slightly higher than the Arts and Science students. This difference may be explained by the fact that there are more Juniors and Seniors in the Education group, while the Arts and Science group includes a comparatively large number of Sophomores who have not yet entered the School of Education.

We may conclude that, while there is some variation in reading ability on the basis of school or college of enrollment, on the whole the differences are too small to necessitate differentiation of instruction on this basis alone.

6. Individual Differences in Reading Ability as Influenced by Where the Student First Learned to Read

We desired to find out what influence the place where a college student learned to read has on his reading ability. We wished to know, for instance, if college students who learned to read in a one room rural school read as well as those who learned to read in a city school. Since the various types of schools vary considerably with reference to type of teacher, methods used, library facilities, and the length of the school term, it was thought that these differences might influence the reading ability of students even after they reached college. We have made an analysis of the 237 subjects under the following divisions: rural school, home and school, small town school, large town and city school and home. In Table 30 are found the average scores made by students on the basis of these divisions.

TABLE 30

Average Scores on the Whipple Test and Special Tests According to Where Students First Learned to Read

Where First Learned to Read	No. of Cases	Whipple Test	Special Tests
Rural School	40	9.7	119.6
Home and School	45	10.9	125.2
Small Town School	57	11.2	128.7
Large Town & City	45	11.6	132.0
Home	50	11.9	129.3
Combined	237	11.2	127.4

Inspection of Table 30 shows a progressive increase on the Whipple test in the order of rural school, home and school, small town school, large town and city school, and home. It will be noted that the Small Town group has a score of 11.2, which is the average for the entire 237 cases. The differences among the groups are rather small; however, the highest group, the Home group, is 22.7 per cent higher than the lowest group, the Rural School group. It might be interesting to note here that the 50 people represented in the Home group were not confined to any one group on the basis of social status. Of the 50 people, 14 were from the farmer group, 12 from the professional group, 14 from the business group, and 10 from the miscellaneous group. This even division among the groups excludes the possibility that social status might have had anything to do with the high scores made by the people who learned to read at home.

The relative standing of the different groups on the Special Tests is the same as on the Whipple test with one exception, the Home group being surpassed in this case by the Large Town and City group. There is again a significant difference between the highest and lowest groups. The students who learned to read in a large town or city school average 10.4 per cent higher on the Special Tests than those who learned to read in rural schools. The Rural School group scores the lowest on both the Whipple tests and the Special Tests.

The low scores made by students who learned to read in rural schools are no doubt explained in part by the shorter school year, poorly prepared teachers, and limited library facilities and textbooks found in rural schools when these people were learning to read. It is evident that students from rural schools are placed under a handicap in reading which is seldom overcome.

The people who learned in large town and city schools and at home rank the highest on both tests. The people from large town and city schools probably had better school facilities, while the people who learned to read at home probably had more individual help and the incentive to read from parents who appreciated the value of reading.

While the differences in reading ability due to the place where the student learned to read are fairly wide, here again they are not sufficient in themselves to form a basis for differentiation of instruction.

The findings in this section suggest certain pressing needs for better educational facilities in rural schools.

7. Individual Differences in Reading Ability as Influenced by Early Instruction in Silent Reading

We were interested in finding out to what extent early instruction in silent reading influenced the reading ability of college students. Question 21 on the questionnaire was "Were you taught silent reading?" Usable results were obtained from 213 students. It was left to the student's own judgment as to what constituted instruction in silent reading. Instruction in silent reading at the time when these students were in the elementary school probably did not consist of what it does today; however, the results indicate that the students who reported having had such instruction had had something that made a difference in their scores on the tests. In order to see whether or not the factor of intelligence caused such differences, the average Otis I. Q. of the two groups was also calculated. Table 31 shows the average scores of those who had instruction in silent reading and of those who did not have such instruction.

TABLE 31

Average Score of Students Who Had Instruction in Silent Reading and of Those Who Did Not Have Such Instruction

	No. of Cases	Otis I. Q.	Whipple Test	Special Tests
Had Instruction in Silent Reading	116	116.0	11.8	129.6
No instruction in Silent Reading	97	112.0	10.4	125.5

The students who reported having had instruction in silent reading score higher on all three tests than those who reported that they had never had such instruction. Those who had instruction scored 4 points, or 3.5 per cent, higher on the Otis test; 1.4 points, or 13.5 per cent, on the Whipple test; and 4.1 points, or 3.3 per cent, higher on the Special Tests.

The higher intelligence may be due to higher reading ability; or, on the other hand, the higher reading ability may in part be due to the higher intelligence. The per cent of difference between the two groups is approximately the same for the Otis test and the Special Tests; however, the difference on the Whipple test, 13.5 per cent, is significant, and while part of it may be explained by the higher intelligence (3.5%), a large part of it seems to be due to the factor of instruction in silent reading.

It should be noted here that the people who reported having had instruction in silent reading were from no one occupational group and had learned to read in no one type of school, but were considerably mixed up in all the factors previously studied in this section.

Viewing the results just presented, we feel safe in concluding that, while the differences noted between the two groups are not sufficient to justify differentiation of instruction on the sole basis of early instruction in silent reading, they are sufficient to indicate that even the comparatively meager instruction in silent reading received when these students were in the elementary school has had an influence on the reading ability of college students. It is therefore, important that this early instruction in silent reading be continued in improved form.

8. Individual Differences in Reading Ability as Influenced by Manner of Spending Leisure Time When a Child

We were interested in knowing to what extent early reading habits of children influenced their reading ability as college students. Does the student, for instance, who liked to read as a child and who spent a great part of his leisure time in reading, have a greater reading ability in the type of material he must read in college courses than the student who spent his leisure time in play? Will he score higher on such tests as the Whipple Reading Test and the Special Reading Tests? If he does score higher on such tests, is the higher score due to his early reading habits or his higher intelligence? In order to obtain the answers to these questions, results from the Otis tests, the Whipple test, and the Special Tests were used in this section according to two divisions of students.

Question 15 on the questionnaire read, "As a child, did you spend most of your leisure time at home in play or in reading?" Students were divided according to answers made to this question into two groups, those who read and those who played. Usable answers were available from 178 students. Only those who stated specifically that they read or played were considered. Many reported "about half and half" while some reported that they never had any leisure time as children. A few left the space for the answer blank.

Table 32 gives the results for the two groups.

TABLE 32

Average Scores of Students According to Leisure Time Occupation as Children

Leisure Time Occupation	Number of Cases	Otis I. Q.	Whipple Test	Special Tests
Read	61	117.1	12.9	135.6
Played	117	112.7	10.3	123.1

Students who read during their leisure time as children score 4.4 points, or 3.9 per cent, higher in intelligence than those who played. It is difficult to state whether the more intelligent students spent their time in reading or whether they are more intelligent because they read. It is very probable that the two factors go together.

On the Whipple test, the students who read as children during their leisure time not only score higher than those who played, but the scores are enough higher to be very significant. The students who read average 2.6 points, or 25 per cent, higher than those who played. While a small part of this higher average score may be due to higher intelligence (3.9%), most of it seems to be due to the factor of early reading habits.

On the Special Tests, the students who spent their leisure time as children in reading score 12.5 points, or 10.2 per cent, higher than those who played. While part of this may be due to superior intelligence, most of it seems to be due to the factor of reading instead of playing.

Viewing as a whole the evidence presented in Table 32, we can summarize it in these two main points: first, students who spent their leisure time as children in reading are slightly higher in intelligence (3.9%) than those who played; and second, students who spent their leisure time in reading are considerably higher in reading ability than those who played, being 25 per cent higher on the Whipple Reading Test and 10.2 per cent higher on the Special Reading Tests.

These differences are significant and worthy of consideration. The slight difference in intelligence may be disregarded as being too small to account for the greater difference in reading ability. It is quite possible that the difference in intelligence is due to the greater reading ability. This leaves most of the differences in reading ability between students who read as children and those who played to be due to the fact that the one group read during leisure time while the other group played.

The fact that a child read during his leisure time rather than played may be due to any one of many different factors or a combination of several. Good home library, incentive from parents who appreciated the value of reading, no unpleasant circumstances that made for a dislike of reading, a feeling of success that comes from reading well, higher intelligence, a weak physical condition preventing success in outdoor sports—all these factors may cause a child to read rather than to play during his leisure time; while poor library facilities, parents who did not like or appreciate reading, early dislike for reading because of inability to read well, poor eyesight, and many playmates may cause a child to indulge in play rather than in reading. The students gave on the questionnaire many factors similar to the ones just listed as having influenced favorably or unfavorably their early reading habits.

Whatever the reasons that caused a particular student to read or play as a child during his leisure time, the fact remains that he did read or play, and that such difference in habits resulted in a decided difference in reading ability when he became a college student. Practice in reading and love for it evidently have a close connection with ability to read.

CHAPTER VI

FURTHER INTERPRETATION OF RESULTS

We have given in detail in Chapter V the results of our study, and in doing so have offered certain explanations and interpretations. We shall now summarize the results found in Chapter V and offer further interpretations with the view of throwing additional light on our problem of providing for individual differences in the reading ability of college students.

A. INTERPRETATION OF RESULTS BASED ON CENTRAL TENDENCIES AND DISPERSIONS.

Dispersions

The most striking thing that stands out in the whole study is the extreme range found in the reading ability of college students. In order that we may have before us the ranges of the distributions for the different tests, we gave in Table 33 a summary of the possible score, the highest score made, the lowest score made, and the range for each of the different tests. We include also the results on the Otis Mental Tests and the Holley Vocabulary Scale for purposes of comparison.

TABLE 33
Summary of Ranges of Distributions for the Various Tests

Test	Possible Score	Highest Score	Lowest Score	Range
Otis Mental Tests	133	131	88	53
		129	92	37
Holley Vocabulary Scale	70	70	31	39
		68	34	34
Whipple Reading Test	20	18	5	13
		18	5	13
Van Wagenen, Science	115	115	67	48
		115	71	44
Van Wagenen, Literature	116	116	71	45
		115	74	41
Special Tests Combined	168	157	85	72
		154	80	74
Test I	42	42	18	24
		40	21	19
Test II	42	42	20	22
		42	17	25
Test III	42	42	16	26
		39	23	16
Test IV	42	39	12	27
		37	8	29
Total Fact Comprehension	40	39	18	21
		38	17	21
Total Application of Facts	64	63	27	36
		61	30	31
Total Location of Facts	64	60	20	40
		58	11	47

Inspection of Table 33 shows that the range on each test for both the fall and the winter groups is wide. It will be noted that the ranges for the different tests vary from approximately 30 per cent to 0 per cent of the total possible distribution.

Other investigators report similar variations. Sperle reports a range of 17 to 3 for freshmen on the Whipple test; Book reports a range of 19 to 1 on the same test; while we find a range of 18 to 5 for Whipple test. McClusky states that he has results showing that the best students in a college group of Juniors and Seniors are four times better than the worst students.

Obviously, it is impossible for students varying so greatly in reading ability to do anything like the same amount of work in a given course.

Since the range as a single measure of dispersion may be somewhat misleading due to the great emphasis given to extreme cases, we summarize in Table 34 the coefficients of variability, which do not give so much weight to extreme scores and are more comparable. It will be remembered that the coefficient of variability is a number showing the per cent that the standard deviation is of the average score.

TABLE 34
Summary of Coefficients of Variability for the Various Tests

Test	Coefficients of Variability
Otis Mental Tests	8.0 7.6
Holley Vocabulary Scale	15.5 13.7
Whipple Reading Test	26.8 24.8
Van Wagenen, Science	10.8 9.3
Van Wagenen, Literature	10.0 10.3
Special Tests Combined	12.4 13.3
Test I	15.7 12.8
Test II	12.4 15.2
Test III	12.4 11.8
Test IV	23.8 29.0
Total Fact Comprehension	16.5 15.5
Total Application of Facts	11.1 13.3
Total Location of Facts	16.4 14.4

Attention is called to the great variability on all the reading tests and especially to the variability on the Whipple test and Special Test Number IV. It is interesting to note, too, the difference in variability for the difference tests, Literature for the fall group being lowest and Special Test Number IV for the winter group being highest, the latter being about three times as variable as the former. It seems that the more difficult the material, the more variable the distribution. McClusky reports that variability increases with technical, difficult material. Limiting the time, as was the case on the Whipple test, also seems to increase the variability. It will be noticed that the variability is much greater on the reading tests than on the Otis Mental Tests, showing that other factors than intelligence are operating in reading ability.

A study of the results summarized in the two immediately preceding tables leads to one outstanding conclusion, namely, that college students do vary in reading ability and the variation is extreme. It is evident that there is not only possibility for individualization of instruction on the basis of reading ability, but also great need for such individualization.

Central Tendencies

Through a study of central tendencies we are able to get some idea of the average performance of the groups with reference to the relationship between actual performance and total possible performance. We are also able to find to what extent the average performance varies with different types of reading material.

In the Whipple test, which is a speed test, the average performance for the group is a little over 50 per cent of the possible performance. The best readers get 90 per cent of the possible score while the poorest readers get only 25 per cent. The average for the highest fourth of the group is approximately 2.5 times that for the lowest fourth. As previously stated, this means that a two-hour reading assignment for the average of the highest fourth is a five-hour assignment for the average of the lowest fourth. A two-hour assignment for the best student in class is a seven-hour assignment for the poorest student.

The average performance on the Van Wagenen tests, which do not have a time limit, is about 80 per cent of the possible performance. The best students get 100 per cent of the possible score while the poorest students get only 60 per cent. The ratios are practically the same for both English literature and general science. The highest fourth of the class averages about 1.5 times the average of the lowest fourth.

Taking the combined scores of the four Special Tests, we find much the same relationships as were found on the Van Wagenen tests. Out of a possible score of 168, there is a range of 77 points for the two groups combined, the highest score being 157 and the lowest 80. The best student does practically twice as much as the poorest. The poorest student gets about 50 per cent of the material while the best student gets over 95 per cent of the material. The mean for the highest fourth of the class is a little more than 1.5 times the mean for the lowest fourth of the class. Since the Special Tests represent a fair sampling of material found in educational psychology textbooks, these results give a good indication of the actual performance on material as usually assigned in educational psychology.

These results show the wide range of individual differences in reading ability of college students on material as assigned in educational psychology and indicate the need for some kind of individualization.

Inspection of the curves of distribution for the performance on the various Special Tests shows the curves to be skewed to the left in the first three tests, while in Test IV the curve is fairly symmetrical. The curves in the first three tests look very much like the lower half of a normal curve of distribution, an indication that the best

students are working to about one-half capacity, while the poorest students not only are working to capacity but are getting only about one-half of the material. The curve in Test IV shows that this test is difficult enough to stop all students. The poorest students get only 20 to 30 per cent of the possible score on Test IV, the average students get 60 to 65 per cent, and the best students 90 to 95 per cent. Varying the type of material as found in Tests I, II, and III seems to have little influence on the average score and the distribution, probably due to the fact that the material in each of these three tests was within the comprehension of the majority of the students. In Test IV, however, the complex and technical nature of the material lowered the mean and increased the variability considerably.

B. INTERPRETATION OF CORRELATIONS.

There is a fairly high correlation between intelligence and reading ability as measured in this study. This relationship is high enough to indicate that the lack of intelligence may be a limiting factor in some cases where college students have difficulty in reading complex, technical material. The variability on the reading tests is greater than the variability on the mental tests, showing that the great variability in reading is not all due to the variability in intelligence. The variation in intelligence may account for many of the small variations found in section "C" of this study. While an individual with high intelligence is not necessarily a good reader, an exceptionally good reader is very likely to be high in intelligence.

Word knowledge is very closely related to reading ability, as is indicated by the high correlations between the Holley Vocabulary Scale and the various reading tests. Word knowledge is probably important enough to receive special consideration in remedial work in reading. Technical vocabulary as used in such subjects as educational psychology is undoubtedly of enough importance to demand special explanation and drill. It is not enough to give a dictionary definition of special terms, but they should be explained in the sense used in the course. The use of diagrams and illustrations may be of value. If a student fails to get the meaning of the more important key words, he is greatly handicapped.

Correlations between different types of reading material as science, literature, and psychology are high enough to show that the different types have many factors in common, but at the same time the correlations are low enough to show that there is no general reading ability but that each type of material demands abilities more or less specific. Common vocabulary, common reading mechanics, common informational background, and like factors are sufficient to account for a correlation of .5 or .6, but between this correlation and unity are many factors not accounted for, making each type of reading more or less unique. This means that improvement in reading in college will usually come through practice in a specific type of material for a specific purpose rather than from a general training for all types of material and for general purposes. This agrees with the theory that learning is specific.

The correlations are high enough to indicate that a student who is a good reader in one type of material is likely to be a good reader in other types of material but this does not necessarily follow by any means. It is possible for a student to read very well simple narrative material and to be a very poor reader in complex material requiring judgment. This means that many students need special instruction in reading certain types of material.

Since the correlations between the various types of reading tests usually run from from .5 to .6, it is not possible to measure reading ability, except approximately, with a single type of test. To measure with a high degree of accuracy will require as many different tests as there are types of reading to be measured.

The inter-correlations between the different types of reading material found in educational psychology are but little higher than the correlations between material as found in the Whipple test, general science, literature, and educational psychology. This fact complicates the problem of measurement in reading. As was stated above, we must have as many different tests as we have types of material to be read, and it is quite probable a different test for each different purpose. This does not mean that we cannot measure approximately with a general reading test, but it does mean that we cannot measure with a high degree of accuracy without a specific test for a specific type of material. The high self-correlations of the Special Tests show that it is possible to measure a single type of reading with a high degree of accuracy. What is needed is a battery of analytical diagnostic tests covering the different types of reading, in order that the particular need of the student may be discovered.

The correlations between the different elements of the Special Tests—Fact Comprehension, Application of Facts, and Location of the Principle—are high enough to indicate that the different processes are rather closely related. The individual who comprehends facts well is likely to apply facts well and to see the relationship between principle and problem.

The correlation between the ability to read material found in educational psychology and scholarship in that subject is fairly high, being .73 for the fall semester group and .65 for the winter semester group. This is high enough to have some little predictive value.

C. INTERPRETATION OF INDIVIDUAL DIFFERENCES IN READING ABILITY AS INFLUENCED BY VARIOUS FACTORS.

There seems to be no significant difference in the reading ability of men and women. The women average slightly higher on both the Whipple test and the Special Tests; however, the difference is too small to be of any consequence.

Age seems to make little difference, within the limits here studied in the reading ability of college students. Students 19 years of age and under read slightly better than any other age group, while those 21 years of age are poorest. Students 24 years of age and over read slightly better than any age group except those 20 years of age and under. Evidently the older students are not handicapped in learning, as far as reading ability is concerned. The great similarity in the reading ability of the different age groups makes it unnecessary to discriminate between students on the basis of age, as far as reading ability is concerned.

Social status makes some little difference in the reading ability of college students, farmers being slightly lower and the miscellaneous group a little higher than the average for all groups. The differences are not enough however, to be significant or require differentiation of instruction.

The year in college makes a slight difference in the average reading ability of college students. There is a progressive increase of 4 to 6 per cent from Sophomore year to Junior year and from Junior to Senior. These differences are negligible, however, as far as the differentiation of instruction is concerned, as the average Sophomore reads much better than the poorest Senior.

School or college of enrollment does not seem to make sufficient difference in the reading ability of college students to make differentiation of instruction necessary on this basis. Students from certain schools average considerably below the mean for the 237 subjects, but the numbers from these schools are too small to justify any conclusions.

The place where college students learned to read has some influence on their present reading ability. The facts show that college students who learned to read in rural schools average considerably lower than the mean for the 237 cases, while

the people who learned to read in city schools and at home average considerably higher than the mean. While the differences are not sufficient for differentiation of instruction on that basis alone, the place of learning to read may be a contributory factor of no little importance in causing poor reading in college. Since about 16 per cent of the people tested learned to read in rural schools, it may be seen that the number is great enough to add considerably to the problems of college instruction. The evidence shows that people learning to read in rural schools are handicapped throughout their whole educational careers. It is obvious that better rural school facilities are needed, in order to prevent this unjust discrimination.

The students who reported that they had received instruction in silent reading averaged higher on both the Whipple test and the Special Tests than the students who reported that they had received no such instruction. While the evidence here is not sufficient to venture a conclusion, the fact that the students reporting instruction in silent reading scored higher in all three sections on the Whipple test and in two sections on the Special Tests indicates that the instruction in silent reading, meager as it probably was, has had some lasting effect.

The fact that the students who reported that they spent their leisure time as children in reading scored 25 per cent higher on the Whipple test and 10 per cent higher on the Special Tests than the students who reported that they spent their leisure time in play indicates that early reading habits have considerable influence on the reading ability of college students.

While the different factors as discussed in this section may each influence an individual's reading ability, no one factor is sufficient in itself to necessitate the differentiation of instruction. They may, however, cause decided differences in reading ability when operating in certain combinations; then, they may contribute to real problems in college instruction.

CHAPTER VII CONCLUSIONS

General Conclusions

The evidence presented in this investigation seems to justify the following conclusions:

1. Extreme individual differences exist in the reading ability of college students.
2. Individual differences in the reading ability of college students are great enough to demand that instruction be individualized to meet the needs of students with varying degrees of reading capacity.
3. The best readers in a course in educational psychology are reading to about 50 per cent capacity for the most part, while the poorest readers not only are working to full capacity but are comprehending only about 20 to 30 per cent of the more difficult material and from 50 to 60 per cent of the easier material.
4. Many college students cannot read sufficiently well ordinary reading assignments in educational psychology.
5. There is a high correlation between the intelligence and the reading ability of college students. It is evident that reading ability is dependent to a fairly high degree on the thing that we call intelligence, and it is quite probable that the score made on an intelligence test is influenced to no small degree by reading ability.
6. General word knowledge as measured by the Holley Vocabulary Scale bears a close relationship to the ability to read material in educational psychology.
7. Correlations between different types of reading material are fairly high, usually from .5 to .6, but they are low enough to show that reading is a fairly specific process requiring a somewhat different technique for each type of material.
8. There is not a general reading ability acquired once and for all time to a sufficient degree to meet all needs of the college student; reading is fairly specific and learning to read is a continuous process.
9. A good reader in one type of reading is likely to be a good reader in other types, but there are many exceptions.
10. It is possible to get an approximate idea of a student's reading ability by the use of a general reading test, but if a more accurate measure is required a specific test must be used for each particular type of reading tested. Perhaps a battery of analytical, diagnostic tests will serve the purpose best.
11. The high self-correlations of tests measuring a specific type of reading show that it is possible to measure with a high degree of accuracy a single type of reading ability.
12. The reading ability of college students is influenced slightly by sex, age, social status, year in college, and school or college of enrollment; however, no one of these influences operating singly is of sufficient importance to necessitate differentiation of instruction on the basis of that factor alone.
13. Early childhood reading habits seem to have considerable influence on the reading ability of college students.
14. Since the different factors influencing reading ability may be combined in so many different ways, either counteracting or reinforcing each other, reading ability is largely a matter to be treated individually.
15. The correlation between Fact Comprehension and Application of Facts is high enough to indicate that the individuals who comprehend facts well are likely to be good on application of facts; however, the correlation is low enough to indicate that there may be many exceptions.
16. The ability to read material in educational psychology is a fair indication

of scholarship in the course, as indicated by the correlations between the Special Reading Tests and the tests and examinations in the course.

Pedagogical Implications

We have shown that individual differences in reading ability exist in extreme degree among college students, and we have suggested that college instruction must recognize and as far as possible make provisions for these individual differences. The question naturally arises as to what can be done under the present conditions of large classes.

Individualization of instruction does not necessarily mean the dividing of classes into many small groups but it does mean locating individual needs and then making the proper adaptations for these individual needs. Most of this work can be handled in the regular class. Each defect or special ability must be treated individually and specifically. All students do not need the same treatment. Many students will not require any particular adjustment.

One of the first considerations is how to locate the reading needs of the various individuals. Since reading ability is the resultant of a multitude of different factors operating in different combinations and in different degrees, it is not possible to discover and segregate the good and the poor readers in an arbitrary manner. This being true, we shall have to depend primarily on the use of tests to determine the reading ability of the different students. It seems that the following procedure might be recommended.

Since intelligence is an important factor in reading ability and correlates high with the different types of reading, it would seem to be worth while to administer a reliable intelligence test. This should be followed by a general reading test in order to obtain an approximate idea of the reading ability of the different individuals and to locate those individuals who are particularly high or low. These more general tests should be followed by a comprehensive analytical, diagnostic reading test covering the different types of material found in the particular subject to be studied. This test would be analytical to the extent that it would locate the individuals who are particularly good or particularly deficient in the different elements of reading as word comprehension, sentence and paragraph comprehension, ability to understand directions, comprehension and application of central thought, and rate of reading.

After the needs of the different students have been located, each must receive special attention. Individualization of instruction will usually be achieved through two methods of attack, namely, helping the student to adjust himself, and adjusting conditions to meet the needs of the student.

Remedial instruction has a real function here since many reading difficulties are easily remedied, being due to carelessness or superficial methods of study. Many times it is only necessary to call the attention of the student to his particular defect and he is able to make the proper adjustment. Many students are greatly surprised to discover that they are poor readers and that they stand relatively low with reference to other members of the class.

Certain general directions will probably be of value to all members of the class. Instruction as to the best methods of studying the particular subject are valuable. Book has found that students can improve their efficiency to a surprising degree when taught how to study. Students may be taught how to use the index, table of contents, chapter headings, and summaries; proper methods of skimming; that reading varies with the specific purposes; and to discriminate between the values of different materials. If certain material is technical and liable to offer any particular

difficulty, it would be well to give a little time in the assignments, pointing out to the students the chief things for which they are to look.

The remaining defects will usually fall under a few well-defined classes such as slow reading due to excessive vocalization, lack of word knowledge, lack of practice, poor informational background, inability to get the whole thought, and physical defects as poor vision. It will probably be necessary for the instructor or assistants to give special attention to helping students who have these particular defects. Methods of treating these and other defects are given in detail in a number of good books now available.

There will remain a few students who will find it impossible to improve under the directions given above because of lack of intelligence or some other deep-seated reason. It will be necessary, therefore, to adjust conditions to meet their needs. Vocational guidance may have a place here, it simply being necessary to tell the student frankly of his limitations and to suggest a line of work more suited to his capacity. In some cases, the student may find it necessary to carry a lighter course, or it may be necessary for him to depend more on lectures, class discussions, and other conversational methods. It may be possible to give such students minimum reading assignments based on material that is simply and clearly stated, containing the fundamentals of the course.

In our efforts to make adjustments for the poor readers, we should not forget that the exceptionally good reader is entitled to special consideration also. Our problem is to make adjustments that will permit every student to acquire success at a level comparable to his capacity. Our results indicate the astounding loss of time and capacity when students superior in intelligence and reading ability are taxed to only 50 per cent of their ability. Such students are liable to form habits of indolence and indifference and to have little respect for a course that challenges them so little.

The superior student can do vastly more than is required of him. Many undergraduate students in the average class could do all the work required of them in one-half or even one-third the time usually given; or these same students could go far deeper into the subject, making an attack worthy of the average graduate student.

The superior student will find it unnecessary to read so much of the simple illustrative material, being able to get his information more rapidly and more effectively from references of an advanced and scholarly nature. While the ordinary student is getting the mere fundamentals of the course, the work of the superior student may be greatly increased and enriched.

Raising the standards of work in college is achieved not only by coaching inferior students and failing the unfit, but also by making adjustments that will cause the superior student to work more nearly up to his capacity.

In some cases, adjustment for the superior student may be best accomplished by placing him in more advanced classes where the work is more intense or the course covers much more ground in a given time. It seems that classification should depend more on capacity to achieve and not so much on previous credit.

The writer ventures to suggest that the reading situation among college students might be greatly improved by more care in the writing of textbooks. This does not necessarily mean that the author write "down" to the student, but it does mean that the ideas should be well stated and conducive to clear thinking. A book that is difficult to understand is not necessarily profound or scholarly.

The success of the individualization of instruction in college on the basis of reading ability depends largely on the attitude of the instructor and his ability to diagnose the needs of the individual student and to enlist the student's cooperation.

Individual differences in reading ability will always exist because of differences

in innate capacity and environment, but the situation will be greatly simplified by better instruction in reading throughout the whole school system and by the realization that reading is not a tool subject that is fully mastered in the elementary school but that learning to read is a continuous process extending throughout the student's whole educational career.

Problems for Further Investigation

In the light of the evidence presented in this study, there seems to be need for further investigation of the following problems:

1. To what extent can the various reading defects of college students be improved?
2. What are the best methods of improving the different defects in the reading ability of college students?
3. There is a need for a number of analytical tests constructed to pick out the particular defects in the reading ability of college students in each of the different college subjects.
4. To what extent are reading defects limiting factors in college success?
5. What are the individual differences in the reading ability of students in college subjects not investigated?
6. To what extent can reading comprehension be improved independent of rate of reading?
7. To what extent does improvement in one type of reading carry over to other types?
8. What are the best techniques for individualization of instruction to be carried on with the regular classroom procedure?
9. What are the best methods of individualizing instruction to meet the needs of the superior student?

APPENDIX

TEST I

Read all directions carefully

Suggestions for effective informational learning or memorizing are contained in the following summary. Read it carefully as the questions in the next two tests are to be answered on the basis of this material.

Suggestions for Effective Learning.

(1) Learning is an active process. We learn those reactions that we practice. Hence the attack should be vigorous and the reaction should be actually the one later to be desired. We should practice actual recall of facts to be mastered.

(2) Since facts are learned through one sensory avenue as well as another, utilize the form of presentation which is mechanically most convenient.

(3) Since the central neurones concerned with one form of imagery or motor mechanism are natively no more modifiable than another, practice—in spelling, memorizing poetry, etc.—that form of reaction which later will be demanded.

(4) Use formal exercises, crutches and other mnemonic devices sparingly and never unless some special reason for them exists. Avoid learning irrelevant materials; avoid forming habits that must later be broken unless the temporary return is obvious and great.

(5) Diligently test recall for errors. Try to detect mistakes before they are “stamped in”; avoid practicing erroneous reactions.

(6) When recall is blocked, try to adopt an active and confident attitude. Search for associated clues. These devices failing, drop the subject for a time before trying again.

In each of the following groups of statements put a check mark *before* the one statement that agrees most closely with the ideas given in “Suggestions for Effective Learning” given on the preceding page.

Learning is

1. Acquiring skill in reflective thinking
2. Listening to a lecture
3. Utilizing the form mechanically most convenient
4. Reflex action consisting of a stimulus and a response
5. Reacting

For economical learning the learner should

1. Practice the reaction desired
2. Use mnemonic devices
3. Practice erroneous reactions
4. Always use the “whole” method
5. Select material of reasonable length and study it carefully

The problem to be learned should be attacked

1. Early in the morning when the mind is fresh
2. In a leisurely manner
3. Before the mistakes are stamped in
4. In a vigorous and active manner
5. Soon enough to be reviewed before class

Facts should be presented through

1. The senses of sight and hearing
2. A form of imagery or verbal mechanism
3. Exercises, lectures, and special reports

4. Diligent study on the part of the pupil
5. The sensory avenue best adapted to the particular problem

The central neurones concerned with one form of imagery or motor mechanism are

1. To be modified by learning to spell and memorize poetry
2. Innately equally modifiable
3. Natively modified by the reaction which will be demanded later
4. Located in the central nervous system
5. Between the sensory and motor organs

In forming habits

1. Use formal exercises, crutches, and mnemonic devices
2. Never form a habit that must be broken later
3. It is sometimes necessary to make changes for specific reasons
4. Practice makes perfect
5. Other things being equal, form the habit in the way that it is to be used later

In regard to errors

1. Practice actual recall of facts to be learned
2. Be careful to detect and eliminate errors before they are drilled in
3. Diligently practice erroneous reactions so that they may be avoided
4. Childhood errors may last throughout life
5. Keep the ideal situation in mind

If recall's blocked

1. Drop the subject for all time
2. Use formal exercises and other memory devices
3. Diligently test recall for errors
4. It is due to poor association
5. In an active and confident attitude search for facts related to the thing to be recalled

If all devices for recall fail

1. They are worthless and should be discarded
2. Recall is blocked and needs more practice on facts to be mastered
3. Do something else for a time and try again later
4. Pay more attention to lectures and review your notes before the examination.
5. One does not have enough confidence in himself

Forming habits that must later be broken may be justifiable if

1. One can do no better
2. They are detached and eliminated before they are stamped in
3. They are based on conditioned reflexes
4. The immediate value is unquestionable and great
5. They are learned by an active process.

Read each of the following paragraphs carefully. If you believe that the ideas in the paragraph agree in general with the ideas found in "Suggestions for Effective Learning" given on a preceding page, put a plus sign *just below* the parenthesis. If you believe that they disagree put a minus sign *just below* the parenthesis. Place *within* the parenthesis the number of the principle in "Suggestions for Effective Learning" agreed with or violated.

- () 1. Miss Blank teaches the multiplication tables by having her pupils sing them. She arranges important dates in history in jingles.
- () 2. Miss Smith says that proverbs and talks about honesty are of little value in teaching honesty to children in the lower grades. She insists, however, that each pupil practice honesty in all his dealings.

- () 3. Miss A insists that children are so constituted by original nature that they learn just as readily through one sense organ as another. Therefore, she chooses the method of giving facts to her pupils that make most clear the thing to be learned and which does it in the most interesting and economical manner.
- () 4. A teacher in elementary psychology uses popular terminology rather than scientific terms until his students get well started in the subject. For instance, he uses the word "picture" for "image" and the word "message" for "nerve impulse."
- () 5. An early educator wrote "What has to be done must be learned by practice—in school, therefore, let the students learn to write by writing, to talk by talking, to sing by singing, and to reason by reasoning."
- () 6. Many correspondence schools use elaborate and complicated memory devices for the purpose of improving memory. They put much emphasis on strange and unusual associations.
- () 7. Miss Brown uses almost exclusively the visual method of presenting facts to her primary children on the theory that children learn most easily through the sense of sight.
- () 8. Such subjects as typewriting and shorthand do not require a vigorous and active attack, being largely mechanical in nature.
- () 9. An elementary school principal insists that his teachers teach spelling by having the pupils write sentences containing the words that they are to learn to spell.
- () 10. At least 95% of our reading after we leave the elementary school is silent reading, yet our schools practically ignore silent reading and give a great deal of practice on oral reading.
- () 11. If a student finds it exceptionally difficult to recall the answer to an examination question, it is good practice to go ahead and answer other questions and come back to the difficult question later.
- () 12. An old teacher years ago gave his pupils the following advice: In the acquisition of a new habit, or the leaving off of an old one, take care to launch yourself with as strong and decided initiative as possible.
- () 13. If you have trouble in recalling an individual's name, give the stimulus a good chance. Look squarely at a person whose name you wish to recall, avoiding doubt as to your ability to recall it. Put yourself back into the situation when you formerly used the person's name.
- () 14. In memorizing a poem pay little attention to small mistakes until the poem is well learned, then eliminate the small errors.
- () 15. If a child has particular difficulty in remembering certain facts, it may be legitimate to use simple memory devices such as the word VIBGYOR which gives the initial letters of the names of the colors in the spectrum.
- () 16. A teacher in a certain school is very enthusiastic over the little plays given by her third grade children. The children enjoy immensely imitating the leading character whose chief characteristic is the use of bad English.

TEST II

Read all directions carefully

The following selection contains some important facts concerning individual differences in human beings. Read the selection carefully as the questions on the next two tests are to be answered on the basis of this material.

Individual Differences

(1) The fact of individual variation is obvious. Whether the grosser physical characteristics of height, weight, and volume of body, or the minute formations of skin-texture and thumbprints be examined, the wide range of variation is apparent. Likewise in function as in structure, the same phenomena are observed; in rate of heartbeat, speed of digestion, or physical strength and endurance, individuality is expressed. The variation in traits of intelligence seems to be just as pronounced.

(2) The principal causes of individual differences are sex, race, remote ancestry, near ancestry, maturity, and training. Just how important a factor each of these causes is and for what each is responsible has only partially been determined. The general result of all studies show that intellectual differences between the sexes are small. Differences between men and differences between women are almost as great as those between men and women. In physical equipment men are stronger and larger, thus excelling in muscular tests and ability to "spurt", but are inferior to women in endurance.

(3) The greater the likeness between members of the same family and their unlikeness to members of other families despite similarities in training suggest the importance of ancestry as a controlling cause. Among children of the same family there is greater similarity in physical traits, particular abilities, mental and moral achievement, and greater likeness between twins than ordinary siblings. But even with twins individual differences exist in various traits to a remarkable degree.

(4) Racial differences exist, but they are much less than is commonly supposed. If we restrict our attention to unselected groups of all but the obviously backward races, there is but little evidence of great superiority of one race over another. The variation within any one race is much greater than the variation among the averages of the several races. The significant fact is the great overlapping of races when compared in different traits.

(5) It should be noted that the existence of special differences does not of itself imply general superiority. It merely implies a difference with respect to the performance of a particular type of work. It is the business of scientific psychology to note individual differences, the specific demands work makes upon certain capacities, and to endeavor to select and direct individuals according to their capacity, talents, interests, and training.

(6) Differences among human beings are quantitative rather than qualitative. That is, all human beings have the same reflexes and capacities; all have the power of perception, discrimination, attentiveness, retentiveness, reasoning, and so forth. All persons, consequently, have the same general qualitative make-up. The variations from person to person are, therefore, primarily, differences in the strength of the various abilities that each individual possesses, and in the manner in which amounts of various traits combine in the same person. The differences are qualitative only in the sense that combinations of varying amounts of diverse traits occur.

(7) Our common terminology of dividing groups of persons into various classes as dull, mediocre, and bright, on the assumption that they may be divided into distinct classes with gaps between them, is psychologically incorrect. The fact is rather that all grades of ability, varying by infinitesimally small amounts from the lowest to the highest, are found in the human species. In a large group, the persons having the different degrees of difference are distributed so that the curve of distribution is continuous, symmetrical, and bell-shaped.

(8) Individual differences are seen not simply as differences with respect to given mental traits, but differences as to general mental capacity ranging from idiocy to genius, the largest number of individuals being normal or average. If we measure

a group of pupils in a given class or grade, we find that on the average the best pupil is able to do from two to twenty-five times as much as the poorest pupil, or is able to do the same task from two to twenty-five times as well as the poorest pupil.

Children of the same chronological age and of the same school year exhibit wide degrees of difference. Ten-year-olds in school are usually found in every grade from the first to the eighth, and if these were arranged in one continuous line according to grade, the physical differences would likewise be in evidence. Thorndike tells us that it is by no means difficult to find seven-year-olds who can do intellectual work in which one in twenty seventeen-year-olds would fail. About ten per cent of the school population of the upper grades can do the work of the schools at the rate of two years' work in one year.

(9) The adjustments made to individual differences should include changes in aims, curriculum, method, content, and grouping of pupils for group instruction; and intensive individual instruction. Likewise, careful adjustments in all physical exercises must be made to meet the needs of each particular pupil. Strong emotional responses, extreme differences in ability, and sensory defects are the differences which most frequently demand adjustment.

In each of the following groups of statements put a check mark *before* the one statement that agrees most closely with the ideas given in "Individual Differences" given on the preceding pages.

An individual is what he is because

1. He is a member of a certain family, sex, race, and has reached a certain degree of maturity
2. Heritage, or "blood", determines the innate equipment of the individual even before birth
3. He inherits native and acquired traits
4. Of his environment and training, for example, housing, food, friends, enemies, and education
5. He is a product of his heredity and environment

The fact that human beings differ is

1. Disputed because children of any particular age group have some fundamental characteristics in common
2. Explained by the similarity of siblings
3. Self evident and may be observed whenever two or more persons are present
4. Proof that women are as intelligent as men
5. Contrary to the Constitution of the United States and should be abolished

Individuals who have the same age from the standpoint of time

1. May differ widely in the amount or quality of achievement
2. Have the same mental age
3. May differ as much as ten years in chronological age
4. Have the same physiological development
5. Can do approximately the same physical and mental tasks

If an immense number of human beings were ranked in relation to intelligence

1. They would fall into three well-defined groups as poor, average, and bright
2. There would be two distinct curves due to sex differences
3. The range of intelligence in men would be greater than that of the women
4. There would be three distinct classes with gaps between them
5. The distribution would show all degrees of intelligence varying by small amounts from the highest to the lowest

Differences among human beings are

1. Due to differences of quality of traits rather than to differences in amount of each trait
2. Compensated whereby a person who is inferior in one respect is superior in other respects
3. Adjusted so that almost every individual is good for something
4. Due to the quantity of the traits involved and the manner in which they are combined in the individual
5. Due to the fact that all do not have the same reflexes and capacities

The importance of heredity as a cause of individual differences is indicated by the fact that

1. Children of the same parents have different heredity
2. Members of the same family may not resemble each other in looks
3. One member of a family may be feebleminded and all the other members normal
4. Even twins have individual differences in various traits to a considerable degree
5. Members of the same family are more alike than members of different families although members of the same family may differ greatly

The type of intelligence is determined by

1. The quantity of each of the different factors of intelligence present and the peculiar arrangement of these factors into complex combinations
2. The possession of a single intelligence
3. Each individual having three intelligences
4. Differences in quality of specific mental traits
5. Some individuals having traits of different qualities

In regard to adjustments in individual differences

1. Individual differences must be modified to fit the school
2. Most individuals having strong emotional responses, extreme differences in ability, or sensory defects should be modified to fit the educational system.
3. It is the function of education to make individuals more alike
4. Education should be adapted to individual differences
5. Individuals of low intelligence cannot adapt themselves to the school and therefore it is a waste of time and money to try to educate them

It is the business of scientific psychology

1. To point out individual differences and make specific changes in these differences so as to make the individual fitted to meet the demands of work
2. To note that the existence of special differences does not in itself imply general superiority or inferiority
3. To help place each individual in the type of work for which he is best fitted
4. To note the specific causes of individual differences
5. To divide people into various classes as dull, mediocre, and bright

If we measure a group of pupils in a given class or grade

1. The largest number of pupils have the same intelligence
2. On the average there is little difference in the intelligence
3. They will range in mental capacity from idiocy to genius
4. The best pupil can do the work of a given grade many times faster than the poorest pupil, or he may do a grade of work many times superior to that of the poorest pupil
5. We find that intelligence is a guarantee of success

Read each of the following paragraphs carefully. If you believe that the ideas in the paragraph agree in general with the ideas found in "Individual Differences" found on the preceding pages, put a plus sign *just below* the parentheses. If you believe that they disagree, put a minus sign *just below* the parentheses. Place *within* the parentheses the number of the principle in "Individual Differences" agreed with or violated.

- () 1. A certain man of prominence believes that too many people are going to high school in the United States, as only a comparatively small number are able to profit to a high degree from the highly intellectual type of work demanded by high schools. The state cannot afford to send boys and girls to high school if they are not capable of adjusting themselves to the demands of the school.
- () 2. The fact, as shown by history, that most of the great contributions to civilization in literature, art, and science have been made by men is proof that men are superior to women in intelligence.
- () 3. A certain primary teacher says that her greatest problems in school are due to differences in pupils. She believes, however, that the chief function of the school is to make people more alike in behavior and demands, therefore, much uniformity in the work of her pupils.
- () 4. One of the arguments against co-education in college has been that the difference in intelligence of the two sexes has led to the lowering of standards of work.
- () 5. A rural teacher says that she does not believe that chronological age is a reliable guide for promotion. As a result of this belief her classes are not at all uniform as to age and size.
- () 6. A writer of psychology stated several years ago that the success of older brothers and sisters in school is a fairly reliable indication of the future success of younger members of the same family.
- () 7. The principal of a small high school insisted that some of the students do more work than others. He compelled some students to take more subjects than others, and required that one boy in the geometry class solve twice as many problems as another boy. Some parents accused him of having discriminated among pupils.
- () 8. A certain college has a fixed rule that all regular students must take sixteen hours work; no more, nor less.
- () 9. Some junior high schools offer pre-vocational courses in which an attempt is made to show pupils the requirements in different occupations and to help each individual find the type of work for which he is best fitted.
- () 10. Plato divided people into three classes, the philosopher, the warrior, and the artisan. Later, individuals were divided into the visual, auditory, and kin-aesthetic types. Today, there are some who insist that children can be separated into two groups, those who "work with their heads" and "those who work with their hands."
- () 11. Miss Blank, an eighth grade teacher, says that John, one of her pupils, possesses absolutely no power of imagination but has a good memory, while James, another pupil, has good perception but his discrimination is zero.
- () 12. The fact that individuals differ does not necessarily mean that one individual is superior to another, but does mean that each is fitted to do a different type of work.
- () 13. A recent writer on educational theory states that we must abandon all theories of types and treat each individual as unique. Each individual must be

treated as a separate problem. Therefore, mass instruction must be supplemented by much individual instruction.

- () 14. Racial differences in intellectual capacity are so great as to preclude the combining of children of different races in the same classes for the purpose of instruction.
- () 15. The principal of a large elementary school in a big city is a great believer in physical training. Through his efforts the school has been provided with a first class gymnasium. He has outlined a set of vigorous exercises for each grade and compels each pupil to do all of the exercises for his particular grade without exception.
- () 16. Sex differences are sufficient on the intellectual side to justify the segregation of the boys and girls for purposes of instruction.

TEST III

Read all directions carefully

The following selection contains important facts concerning "Efficiency as Influenced by External and Internal Conditions." Read the selection carefully as the questions on the next two tests are to be answered on the basis of this material.

Efficiency as Influenced by External and Internal Conditions

(1) Nearly everyone has a number of convictions concerning the influence of various conditions such as fatigue, interest, the weather, time of day, noise, coffee and tobacco upon behavior. Long the subject of speculation and opinion, many of these conditions have been subjected within recent years to experimental study. Some of the results of experimental studies on the influence of external and internal conditions on efficiency and improvement will be given, with little attempt to account in detail for the causes of the effects observed. In most instances the detailed ways in which the effects are brought out are not known, descriptions of the causations are more complex than is necessary for our purposes.

(2) Experimental evidence on the remarkable capacity of the organism to adapt itself to unusual conditions has been obtained. For example, students during periods of from 30 to 48 hours without sleep, although subject to pronounced "feelings of fatigue" and other uncomfortable symptoms, were nevertheless able to perform mentally as efficiently and learn as effectively as under ordinary conditions. During a fast of 31 days, a man studied by Langfeld showed no appreciable loss of mental efficiency and ability to learn, although the decrease of bodily weight and strength was great.

In the study mentioned above (Knight and Remmers) some of the subjects during five days were given Hinkle's pills, not permitted to shave or bathe, were forced to carry with them everywhere weighty articles, were "paddled" with barrel-staves, forced to eat raw liver ("ostensibly dog-meat") were subjected to realistic but fake "brandings" and otherwise hazed, were allowed only one or two hours sleep in twenty-four, and during the twenty-two waking hours were required to do menial work about the house, or go "frequently" on hikes of 12 to 15 miles, in addition to carrying on their regular university work. Despite all of these hardships, under strong motivation (desire to get into a college fraternity), they appear to do simple mental work as well as usual. Such facts bear witness to the remarkable stability of the mechanisms involved in well habituated mental activities. It is surprising that these functions, which may be so readily allowed to operate below maximum in the absence of incentives, remain unimpaired in efficiency, during and after such extreme deprivations and exertions.

(3) Some of these adaptive reactions—to heat, cold, low humidity continuous work, loss of food—appear to be directly instinctive; that is, they are carried out as in case of the infant, by adjustments inborn rather than learned. The adaptations to new noises, or visual distractions, while involving instinctive acts, are nevertheless, in a genuine sense, acquired. The process of overcoming an auditory distraction affords, as we have said, a beautiful example of trial-and-error learning in which elimination and selection continues until the adjustment becomes easy, smooth, and nearly unnoticed. That these adaptations are, however, really active adaptations is indicated by the fact that when the stimulus, to which an individual is adapted so completely that it is unnoticed, is removed, he becomes aware of the change and must make another adjustment to the rearranged conditions. Thus when one is adapted to a certain rattle or roar in his working environment, removal of the sound may be temporarily disturbing, although readjustment is shortly achieved.

(4) Caffeine is an active drug in tea, coffee, and many soda-fountain drinks. An average cup of hot black tea contains 1.5 grains; an after-dinner coffee about the same; an average glass of cold green tea about 2.0 grains; and a large cup of coffee about 2.5 grains. The effect of a dose of caffeine appears usually within an hour and lasts for several hours, depending on the size of the dose. This substance usually produces a decrease in muscular steadiness and tremors which appear more quickly and last longer with larger doses. In typewriting, greater accuracy results from using the drug, while speed is also increased except by large doses which reduce the rate of writing. In more purely mental work—naming the opposites of words, naming colors, adding, etc.—efficiency was increased by doses of all sizes for periods varying from three to seven hours. In the task of crossing out certain numbers from rows of mixed numbers doses of four grains or more produced improvement in ability which sometimes persisted for nearly 24 hours. The stimulating effect of the drug was indicated by the fact that a dose of six grains disturbed the sleep of most subjects, and on some much smaller doses had a similar effect. The stimulating influence of caffeine, contrary to general opinion, is not followed by a subsequent period of depression, at least not within 72 hours. When injected into animals, caffeine augments all conditioned reflexes, and at the same time diminishes every inhibitory process, with the result that after a dose of caffeine of .025 to .05 gram it is very difficult, or practically impossible, to extinguish a conditioned reflex. Discriminations vanish in delayed and trace reflexes. The effect of caffeine develops to a maximum in about twenty to thirty minutes after the injection and lasts for at least one day.

(5) Experimental results show that the influence of tobacco smoking is a rather variable matter. With some the immediate effects are detrimental but after an hour or so of continuous smoking they pass off, leaving the performance uninfluenced, or, rarely, slightly improved. With others the immediate effect may be beneficial while continued smoking brings on unfavorable effects. On the whole, tobacco seemed to slow down and disturb the mental abilities tested slightly. The effects were little more pronounced in the case of non-habitual smokers. No individual was always unfavorably influenced in all of the tests, however; there was only a tendency for tobacco to exert a detrimental influence more frequently than a favorable influence. The average loss in mental efficiency for all the subjects for all the tests was about 5 per cent. Tobacco smoke rather uniformly accelerated the heart beat and reduced the steadiness of motor control; these were the most consistent and pronounced effects. Concerning the effects of tobacco on general health, ambitiousness, creative inspiration and the like, there are opinions in abundance, but no reliable data.

(6) During extensive and carefully controlled investigations in the Nutrition Laboratory of the Carnegie Institute, it was found that alcohol had not a stimulating but a

depressing effect upon mental and motor efficiency. To this statement there was one exception—the pulse was accelerated, which was symptomatic, perhaps, of internal resistance to the drug. In all tests the effect of alcohol is to reduce functional capacity, and this is strikingly true of the simple protective reflex activities which become more sluggish in rate and less effective in extent. The influence of alcohol on both motor and mental functions has been recently investigated by Hollingsworth who found the loss of efficiency due to alcohol to be universal and pronounced among the functions tested, with the exception of the rise in pulse rate. Coordination of motor control and speed of tapping are appreciably reduced, steadiness is more markedly disturbed. On mental efficiency the drug has a similar disastrous effect, similarly proportional to the size of the dose.

(7) It is popularly believed that in poorly ventilated rooms, carbon-dioxide and other toxins from expired air result in drowsiness, lassitude, and loss of efficiency. Experiments show, however, that high temperature or humidity or both rather than low oxygen content and expired matter seem to be the cause of the discomfort. Experiments show further that the atmospheric conditions encountered in ordinary life, however uncomfortable some of them may be, have no appreciable effect upon efficiency in performance, or in improvement in mental and light motor work when moderate motivation is present.

(8) Just as the organism becomes adapted to wide differences in light or temperature, so it becomes adapted to auditory distractions. It is also quite clear that the ordinary work of the school day is not so severe as to reduce efficiency perceptibly, and it would appear to make little difference at what hours mental work is pursued. So far as mere loss of efficiency is concerned, there is little to urge against long continued work of the same sort, however, too lengthy application to a task may make the work uninteresting or positively repugnant. But it is the repugnance, exasperation, excitement or worry produced by mental work rather than the work itself which is harmful.

(9) The results of experiments given in this selection disclose only the immediate effects of external and internal conditions on efficiency. It would be unsafe to conclude that the results would be the same if the experiments were extended over a long period of time. Furthermore, efficiency is not the only consideration. Conditions should be such that efficiency is maintained with a minimum of mental and physical strain.

In each of the following groups of statements put a check mark *before* the one statement that agrees most closely with the ideas given in "Efficiency as Influenced by External and Internal Conditions" given on the preceding pages.

Alcohol

1. Has a stimulating and depressing effect on mental and motor efficiency.
2. Retards the heart action and increases the coordination of motor control.
3. Is a stimulant to mental processes and aids in thinking
4. Is depressing and reduces mental and motor efficiency
5. Reduces mental efficiency but stimulates physical activity

Poorly ventilated rooms result in drowsiness, lassitude, and loss of efficiency because

1. The air is hot and contains moisture
2. The air is bad having been breathed several times
3. The air is not kept in motion
4. No means has been provided for ventilation
5. Oxygen has been decreased and carbon-dioxide increased

Caffeine taken into the system

1. Is first stimulating and then depressing
2. Is harmful to children
3. Retards conditioned reflexes and increases inhibitions
4. Acts as a stimulant while alcohol is depressing to mental and motor processes
5. Is followed by harmful consequences

The influence of tobacco smoking

1. Is especially harmful to young persons
2. Is neither good or bad, therefore, not a moral issue
3. Is detrimental to health, ambition, and creative thinking
4. Retards the heart action and helps one to think
5. Has not been fully determined, but seems to reduce mental efficiency

The results of the experiments mentioned in this selection show

1. That popular convictions concerning the use of drugs, tobacco, and coffee are correct
2. That alcohol is not harmful when extended over a short period of time in moderate quantities
3. The influence of the mentioned materials over a long period of time
4. In detail the causes of the effects observed
5. The immediate effects of external and internal conditions on efficiency

The study of the efficiency of subjects undergoing initiation shows that

1. Initiation exercises are unusually severe and perhaps dangerous
2. Men will subject themselves to severe hardships to get into a fraternity
3. Mental efficiency may be maintained in spite of hardships and deprivations if the motivation is strong
4. Loss of sleep and long hikes had little effect on the physical efficiency of these college students
5. Men will eat raw dog liver if properly motivated

Adaptive reactions

1. May be either native or learned or a combination of both
2. As putting on a coat when cold or taking it off when hot are native rather than learned
3. Are always made to noises and never to absence of sound
4. In the case of the infant are all native while those of the adult are entirely the result of trial-and-error learning
5. Are always conscious

The human organism

1. Always maintains a high degree of efficiency in spite of distractions
2. Is not capable of adjusting itself to unusual conditions
3. Usually performs its functions far below its capacity
4. Can be exposed to extreme deprivations and exertions over an unlimited period of time without loss of mental efficiency
5. Is capable of adjusting itself to all external and internal conditions if properly motivated

From the standpoint of the school

1. Worry, excitement, lack of interest, and dislike of work are real factors influencing the learning process and should be carefully controlled
2. The highest mental efficiency is found the first hour in the morning
3. Mental fatigue is the most common factor limiting mental efficiency
4. Mental efficiency is the only factor involved
5. All noises are distractions

Strong motivation

1. Is sufficient to maintain mental efficiency in spite of ordinary distractions, fatigue, bad air, and temperature extremes
2. Can maintain mental efficiency in school, therefore it matters little if ventilation, humidity, and temperature are not properly maintained
3. Can maintain mental efficiency over an unlimited period of time
4. Is easily maintained in ordinary school activities
5. Can overcome all distractions

Read each of the following paragraphs carefully. If you believe that the ideas in the paragraph agree in general with the ideas found in "Efficiency as Influenced by External and Internal Conditions" found on the preceding pages, put a plus sign *just below* the parentheses. If you believe that they disagree, put a minus sign *just below* the parentheses. Place *within* the parentheses the number of the principle in "Efficiency as Influenced by External and Internal Conditions" agreed with or violated.

- () 1. The president of a certain business college says that students can and should learn to adapt themselves to various distractions as found in business offices in the city. His business college is located on a busy and noisy street.
- () 2. An army physician says that a moderate amount of strong coffee has not proved injurious to mental functions of men in the training camp, in fact, it seems to add to their efficiency.
- () 3. An Arctic explorer does not permit the men under his command to use alcohol because he believes it to be deadening to mental efficiency and detrimental to accurate motor control.
- () 4. The leader of a certain organization states that she has positive proof, scientific and reliable, that smoking is highly injurious to human beings and gives as proof the large number of individuals of low intelligence who smoke.
- () 5. A university professor says that most human beings are as lazy as they dare be and that only a crisis can make them react with a maximum of efficiency.
- () 6. School work has proved so fatiguing that some schools have deemed it advisable to institute a rest period from one to two o'clock.
- () 7. If pupils are properly motivated, their efficiency is influenced but little by atmospheric conditions as found in ordinary life.
- () 8. A factory owner claims that scientific tests have proved that the detrimental influence of bad lighting, poor air, and excessive temperature conditions has been greatly exaggerated in the past, and objects to making changes to better sanitary conditions and to make the workmen more comfortable. He says that his workmen are efficient under present conditions.
- () 9. The directors of one of the best rural schools in Missouri object to remodeling the school building so as to make it conform to the state requirements of unilateral lighting on the ground that the work done in the school is highly efficient and that the school ranks as one of the best in the state.
- () 10. A certain surgeon takes a little alcohol before a particularly difficult operation "to stimulate the mind and to steady the hand."
- () 11. A superintendent of a city school system arranges the daily schedule of classes so that the most difficult subjects come during the first hours of the morning while the pupils are fresh and alert.
- () 12. A high school text in physiology and hygiene gives a detailed description of the ways in which coffee, tobacco, drugs, and alcohol affect the various organs of the human body.
- () 13. The owner of a large factory for making shoes has recently installed expensive apparatus for carefully regulating temperature and moisture of the air

in the plant. He finds, however, that the workmen are no more efficient than before, but they seem to be more cheerful and work with more comfort.

- () 14. A moderate dose of caffeine lessens muscular steadiness, but increases speed and accuracy in typewriting and is not followed by any immediate depressing effects. When injected into animals, caffeine augments acquired reactions and diminishes inhibitory processes, making it difficult to extinguish conditioned reflexes. The effect of an injection of caffeine is greatest after twenty or thirty minutes, and it may last for twenty-four hours or more. A large dose of caffeine is stimulating and disturbs the sleep of many people.
- () 15. A teacher states that her pupils can carry on a given type of work for a long period of time without loss of efficiency, however, there is a tendency for the work to become monotonous if pursued too long. Worry and excitement in connection with work are more liable to be harmful than the work itself. It is not necessary for the schoolroom to be quiet as the pupils soon adapt themselves to the ordinary routine noises and are not distracted unless something unusual occurs. The pupils work just as well in the afternoon as in the morning and seem to be just as efficient.
- () 16. The results of the experiments given above show only the temporary influence of internal and external conditions on health. If extended over a long period of time the results would, no doubt, be roughly the same, however, we must not draw conclusions unless we have all the facts. The school must be sure that it is right before it makes expensive changes.

TEST IV

Read all directions carefully

The following selection contains important facts concerning "Transference of Training." Read the selection carefully as the questions on the next two tests are to be answered on the basis of this material.

Transference of Training

(1) To what extent does training in one mental function or set of functions modify the operation of other mental functions? To what extent will training in mathematical reasoning modify reasoning ability about political events or bargains, or vice versa? To what extent will training in remembering faces and names modify the remembering of the prices of goods or words in a language or vice versa? To what extent will improvement in proficiency in such mental capacities as are involved in school studies modify proficiency in any other specific or general activities or interests in life? These problems open up all the ramifications of the traditional controversy concerning mental discipline, the educational value of school subjects, and the related discussions. The fundamental problem, however, is not, does training transfer? The task is more complex and suggests rather the following three fundamental problems: (1) To what extent does training transfer, (2) To how closely or how distantly related functions does training transfer, and (3) How does the transfer take place? Thus we see that transference of training is one of the three or four most important perennial problems in the entire field of education.

(2) In order to think about these matters clearly, it is necessary to distinguish between two quite different aspects of the discussion, namely: (1) The pure disciplinary or training value in the improvement of a mental function irrespective of the material through which it is trained or which is acquired in the training; (2) the intrinsic value

of the information or material acquired in the process of training irrespective of the training referred to in (1). The one is acquisition of training; the other is acquisition of content. The difference between these two aspects may be illustrated thus; the learning of shorthand will furnish practice of certain types of memory and associative processes; it will also supply the individual with certain symbols for recording ideas. The former would be pure training value of mental functions, the latter would be the informational or instrumental value of shorthand. If one should never expect to use the symbols of shorthand for recording ideas, to what extent would the practice in memory and associative functions modify memory and associative processes in other reactions in life? Viewed from the standpoint of the school, the situation presents two problems: (1) To what extent does training of mental capacities involved in a given school subject carry over and produce efficiency in other subjects or in other activities in life, and (2) are certain school subjects more capable of improving the mental functions generally and of carrying the improvement over to other responses of behavior?

(3) The rigid supporter of formal discipline is in reality an adherent of the antiquated faculty psychology. Like the phrenologist he conceives of the mind as being made up of fixed forms or faculties. Accordingly, if one of these "faculties" like that of memory is trained or disciplined with one kind of exercise such as memorizing poems, then the beneficial results of this training will be evident in the markedly improved retention of everything else. Since the study of grammar calls for the analysis of sentences, the discipline it gives the "analytic faculty" will fortify the student's ability to analyze business problems, chemical compounds, murder mysteries—in short, any affair that involves analysis. While no psychologist today lends credence to this extreme application of the principle of transfer of training, it is unfortunately true that many educated, non-psychologically trained individuals do. Until twenty-five years ago the problem was discussed wholly as a matter of opinion. During the last twenty-five years, a considerable number of researches have been made on many aspects of the problem so the controversy may be dealt with in a more definite and factual manner than was formerly the case.

(4) It may perhaps be unwise in view of the intricacy of the researches and their partial incongruity to attempt to summarize general conclusions. However, a brief resume will help to clarify the reader's thinking about these problems. (1) Practically every investigation shows that improvement in one mental or neural function is accompanied by a greater or less amount of modification in other functions. (2) This modification is in most instances a positive transfer, that is, an improvement. Negative transfer, that is, loss of efficiency in other functions, or interference, has been reported principally among sensorimotor habits. (3) The amount of improvement in the capacity trained is probably never accompanied by an equal amount of improvement in other capacities, with the possible exception of a few isolated instances whose actuality may be questioned. As a general estimate, on the basis of experimental work done this far, the amount of transfer between the extremes of 100% and 0% of transfer lies nearer to the zero end and is probably in the neighborhood of 20% to 30% of transfer to closely allied functions and from that point on down to 0% of transference to more unlike functions. (4) In the fourth place, the improvement spread to other functions diminishes very rapidly in amount as these other functions become more and more unlike the function specifically trained. This diminution occurs at a surprisingly rapid rate.

(5) If improvement in one mental function is accompanied by, or produced improvement in, other functions, how may the change in these other mental functions be explained? How does change in one function carry over to others? Two general

theories have been proposed. First, the theory of identical elements or special connections is advocated by Thorndike and may best be stated in his own words:

"The answer which I shall try to defend is that a change in one function alters any other only in so far as the two functions have common identical elements. The change in the second function is in amount that due to the change in the elements common to it and the first. The change is simply the necessary result upon the second function of the alteration of those of its factors which were elements of the first function, and were so altered by its training. To take a concrete example, improvement in addition will alter one's ability in multiplication because addition is absolutely identical with a part of multiplication and because certain other processes,—e. g., eye movements and the inhibition of all save arithmetical impulses,—are in part common to the two functions.

"Chief amongst such identical elements of practical importance in education are associations including ideas about aims and ideas of method and general principles, and associations involving elementary facts of experience such as length, color, number, which are repeated again and again in different combinations.

"By identical elements are meant mental processes which have the same cell action in the brain as their physical correlate. It is of course often not possible to tell just what features of two mental abilities are thus identical. But, as we shall see, there is rarely much trouble in reaching an approximate decision in those cases where training is of practical importance." (Thorndike, '14 II, pp. 358-359.)

The theory of identical elements is based on the doctrine that learning or changes in mental capacities consist of the establishment of specific connections or associations between various specific elements. One form of exercise has influence upon another capacity whenever connections established in the former may be also used in the latter. In a certain sense the theory of identical elements describes or explains transfer in a tangible, concrete manner. In a certain other sense it does not explain transfer of training at all or else it implies that there is no general training in the sense in which formal disciplinarians use the term.

(6) A second theory attempting to explain the transfer of training is the theory of generalization advocated by Judd. The theory of generalization attempts to explain spread of improvement in terms of the recognition of application of an experience obtained in one connection to other connections and is probably more satisfactory to the formal disciplinarian.

"The important psychological fact.....is that the extent to which a student generalizes his training is itself a measure of the degree to which he has secured from any course the highest form of training..... James has discussed this matter by using the example of the animal trained to open a particular latch. The animal becomes acquainted with the necessary movements to open one door, but he never has the ability to generalize this experience. He cannot see that the same method of opening doors is applicable to many other latches." (Judd, '15, pp. 413-414)

In the author's opinion there is no necessary opposition between the theory of identical elements and the theory of generalization. The essential difference is in the emphasis upon the conscious recognition of identical elements in as many situations as possible. Judd has emphasized this in connection with teaching:

(7) "The first and most striking fact which is to be drawn from school experience is that one and the same subject-matter may be employed with one and the same student with wholly different effects, according to the mode of presentation. If the lesson is presented in one fashion it will produce a very large transfer; whereas if it is presented in an entirely different fashion it will be utterly barren of results for other phases of mental life. It is quite possible to take one of the objects of nature

study, for example and to teach it in such a way that it becomes an isolated and utterly formal possession of the student.....In exactly the same way a teacher who knows how to make use of the materials given in a Latin course may render this subject very broadly productive, as contrasted with the teacher who merely gives the formal aspects of the subject. Formalism and lack of transfer turn out to be not characteristics of subjects of instruction, but rather products of the mode of instruction in these subjects." (Judd, '15, pp. 412-413.)

(8) The transference of training of the capacities involved in the learning of school material is very small so far as present partial data indicate. Experimental and statistical inquiries into the transfer of training indicate that the effects of training are transferred in smaller amounts and within much narrower limits than has commonly been assumed. Any superiority of students taking certain subjects must be explained as due to the superior native ability of students choosing those subjects rather than to the study of those subjects. So far as the value of a school subject is concerned, it means that the content value of a subject must be the prime reason and the general disciplinary value the secondary reason for pursuing it. The maximum returns will come when subjects of the highest content value are taught in a manner to produce the greatest possible transfer.

(9) Before leaving this discussion, two further points should be borne in mind: The first is that any effect of transfer, even if very slight, would probably be worth while if it extended to all or to a very large number of capacities. The second point is, that while the trend of the arguments here presented would be to reduce the time devoted to some subjects, particularly in high schools and college, we must be sure that we put something better in their places, as the older subjects are apt to be well organized for teaching, while some of the new substitutes offer neither form nor content.

In each of the following groups of statements put a check mark *before* the one statement that agrees most closely with the ideas given in "Transference of Training" given on the preceding pages.

The chief problems concerning the transference of training are

1. Disciplinary and intrinsic
2. How, how much, and when does transference take place
3. Intricate and marked with incongruity
4. Identical elements and generalization
5. Does a subject like Latin or mathematics train the mind more than subjects like agriculture or home economics

The theory of identical elements

1. Is based on the theory of faculty psychology
2. Is advocated by Judd
3. Explains transfer of training in the sense in which formal disciplinarians use the term
4. Is based on the belief that learning involves the forming of specific bonds between specific elements of stimulus and response
5. Is based on theory that a function or faculty may receive a general training or improvement that carries over to specific situations

Transfer of training

1. Is always positive
2. Is always between 0% and 100%, but nearer to zero
3. Is usually very large
4. May be in the nature of interference
5. Increases as the functions become more and more different

The study of grammar

1. Trains in the general power of analysis if sentences are analyzed
2. Gives discipline to the analytic faculty
3. In one language will not transfer to study of grammar in another language
4. Would probably transfer 20% to 30% to the analysis of chemical compounds because of elements in common
5. May transfer to the solution of murder mysteries if the two situations have common elements

The amount of transfer

1. Is so small the school should emphasize the content values of subjects and pay no attention to transfer
2. Is not influenced by the method of teaching
3. Is mere opinion
4. Is smaller and within narrower limits than was formerly believed, but may be worth striving for if it extends to a large number of functions
5. Is definitely known for most school subjects due to investigations of the last twenty-five years

School subjects

1. Should be taught primarily for their transfer value
2. Such as grammar and chemistry train the faculty of analysis
3. Should be taught primarily for their content values, but the transfer value should be emphasized
4. Of the newer type are more desirable than the older subjects
5. Of the old disciplinary type should be eliminated

The author of this selection on the "Transference of Training" believes

1. That the chief problem is whether or not training really transfers
2. That the theory of identical elements is wrong and that the theory of generalization is correct
3. That the theory of identical elements is the only theory that is true with reference to transference
4. That the amount of transference is fully established by experimental evidence
5. That there is not necessarily a conflict between the theories of Thorndike and Judd on the question of transference

Transference of training

1. Is twenty-five years old
2. Is the most important problem in the field of education
3. Is an antiquated problem dating back to the time of faculty psychology
4. Is not believed by most educated people except those psychologically trained
5. Continues to be one of the most important problems of education although researches have been going on for twenty-five years

Researches in the field of transfer of training indicate

1. That improvement in one mental or neural function is seldom accompanied by modification in other functions
2. That if there is a modification there is an equal chance of its being positive or negative
3. That there is apt to be a small positive transfer, decreasing rapidly as the functions become more differentiated
4. That there is no such thing as formal discipline
5. That the problem of transference is about solved through adapting the method to function involved

From the standpoint of the school transference presents two problems as follows:

1. (a) Are school subjects of equal value? (b) To what degree does each transfer to other subjects or life problems
2. Is transference due to (a) acquisition of content or (b) acquisition of training
3. Is transference positive or negative
4. Is transference due to method or content
5. Which is correct Thorndike or Judd

Read each of the following paragraphs carefully. If you believe that the ideas in the paragraphs agree in general with the ideas found in "Transference of Training" found in the preceding pages, put plus sign *just below* the parentheses. If you believe that they disagree, put a minus sign *just below* the parentheses. Place within the parentheses the number of the principle in "Transference of Training" agreed with or violated.

- () 1. The mind is composed of a number of separate faculties, and from this it readily follows that these can be educated in their entirety and made to serve in various situations of life equally well for all purposes.
- () 2. The fact of transfer cannot be doubted. The factors involved in such transfer, the extent to which transfer can take place under any given set of conditions and the best methods of securing such transfer will long doubtless remain questions for investigation and discussion.
- () 3. There is considerable evidence showing that students making the highest records in college are those from the classical courses. This is no doubt due to the superior value of the classics in transference.
- () 4. As applied to methods of teaching, the problem of making class instruction transfer to life activities outside the classroom is chiefly the problem of teaching the pupils to generalize. To generalize is to discover the common elements in a variety of situations. Finally, the pupils must practice applying the ideal, principle, habit, etc. to new situations.
- () 5. If the extreme doctrine of transfer is tenable, it does not make so much difference what is taught: mathematics will possess disciplinary value for those who are never to make any more extended use of it than is involved in running a family budget or in keeping a check-book balanced. They will be better artists, better business men, better citizens, through the beneficent influence exerted over them by systematic study of algebra and higher mathematics.
- () 6. A simple habit is a specific response to a specific stimulus. It is clear that so far as a generalized habit is concerned, the term is a psychological absurdity. The very essence of a habit is the specific character of its response. An habitual adjustment is a definite reaction called forth by some specific stimulus or combination of stimuli. The habit of neatness in arithmetic does not carry over to neatness in language and spelling papers.
- () 7. Improvement, in any single mental function, need not improve the ability in functions commonly called by the same name. It may injure it. For instance, crossing out T's may interfere with crossing out P's or vice versa.
- () 8. The intrinsic value of higher mathematics and Greek is not large for the average individual, however, the training value in the improvement of mental functions irrespective of material justifies their study.
- () 9. A teacher can teach birds and plants in such a way as to arouse a minimum of ideas in the student's mind. The training may be as formal in these content

subjects as it ever was in language instruction. On the other hand, the same subject matter may be taken by a different teacher, and under other methods can be made vital for the student's whole thinking. Therefore, method is an element in transfer.

- () 10. Our intellectual skills are not potencies, fairies, or Gold Dust Twins which can skip into any type of work at our bidding. Even "memory" is but a word to sum up many different skills ranging all the way from mechanical repetition to an intensive, complex, analytical attack upon new material. We do not transfer abilities but use the same S—R in different situations.
- () 11. One teacher states that she teaches arithmetic in order to train the child to think straight; another teaches it for the purpose of teaching citizenship through situations involving number relationships.
- () 12. Scientific research has led us to have more rather than less faith in transfer. Facts show what was formerly only conjecture.
- () 13. The best way to improve the judgment faculty is by judging; the best way to improve the reasoning faculty is by reasoning; the best way to improve the memory is by memorizing, etc. Mathematics offers ideal subject-matter upon which thus to exercise these faculties. Laboratory science is an excellent means of developing general habits of precision and conservative thinking.
- () 14. A teacher of algebra and plane geometry decries the use of problems of application of mathematical principles and makes the following claims: "My pupils increase in mental power, breadth of vision, accuracy, thinking ability, critical judgment, remember better, and have a keener appreciation of the beautiful."
- () 15. School subjects have been divided into two classes depending upon their particular functions: (a) content or informational subjects, and (b) disciplinary or training subjects. A disciplinary subject is one that has an intrinsic value irrespective of training, while a content subject is one that is valuable not within itself but because of powers of general transference to other situations.
- () 16. No subject should remain in the curriculum because of its disciplinary value alone.

SELECTED BIBLIOGRAPHY

- Book, William F., How Well College Students Read. *School and Society*, Volume 26, August 20, 1927, pp. 242-ff.
- Courtis, S. A., Analysis of Reading Ability. *Journal of Educational Research*, Volume 4, pp. 287-293.
- Evenden, E. S., The Improvement of College Teaching. *Teaching College Record*. Volume 29, April 1928, pp. 587-596.
- Garrett, Henry E., *Statistics in Psychology and Education*. Longmans, Green and Company, 1926.
- Good, Carter V., An Experimental Study of the Merits of Extensive and Intensive Reading in the Social Sciences. *School Review*, Volume 33, December 1925, pp. 755-770.
- Gates, Arthur I., Methods of Constructing and Validating the Gates Reading Tests. *Teachers College Record*, November 1927, pp. 148-159.
- Gates, Arthur I., *The Improvement of Reading*, Macmillan Company, 1927.
- Gray, William Scott, Summary of Reading Investigations. *Elementary School Journal*, Volumes 26, 27, and 28.
- Haggerty, M. E., The Improvement of College Instruction. *School and Society*, Volume 27, January 14, 1928.
- Irion, Theo. W. H., Comprehension Difficulties of Ninth Grade Students in the Study of Literature. *Teachers College, Columbia University, Contributions to Education*, Number 189, 1925.
- Kelly, Truman L., *Statistical Method*. Macmillan Company, 1923.
- McCall, William A., *How to Measure in Education*. Macmillan Company, 1922.
- Miles, Dudley H., Can the High School Pupil Improve his Reading Ability? *Journal of Educational Research*, Volume 14, September 1926.
- Pressey, Sidney L. and others, *Research Adventures in University Teaching*. Public School Publishing Company, 1927.
- Sangren, Paul V., The Measurement of Achievement in Silent Reading. Doctor's Dissertation, University of Michigan, 1927.
- Thorndike, Edward L., Reading as Reasoning. *Journal of Educational Psychology*, Volume 8, June 1917, pp. 323-332.
- Thorndike, Edward L., Understanding of Sentences. *Elementary School Journal*, Volume 18, October 1917.
- Wood, Ben D., *Measurement in Higher Education*. World Book Company, 1923.
- Year-Book, the Twentieth, of the National Society for the Study of Education. Public School Publishing Company, 1921 (Part II).
- Year-Book, the Twenty-Fourth, of the National Society for the Study of Education. Public School Publishing Company, 1925 (Part I).
- Yoakam, Gerald A., The Effects of a Single Reading. *University of Iowa Studies in Education*, Volume 2, Number 7, March 15, 1924.
- Yoakum, Gerald A., *Reading and Study*. Macmillan Company, 1928.

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